THE SIGHT-SAVING REVIEW

March, 1939

"Let There Be Sight"

Volume IX
Number 1

PUBLISHED QUARTERLY BY
THE NATIONAL SOCIETY FOR THE
PREVENTION OF BLINDNESS, INC.

The National Society for the Prevention of Blindness presents the articles printed in THE SIGHT-SAVING REVIEW upon the authority of its writers. It does not necessarily endorse or assume responsibility for opinions expressed or statements made. The reviewing of a book in THE SIGHT-SAVING REVIEW does not imply its recommendation by the National Society.

Price $2.00 a year; single copies 50 cents

Published quarterly by the National Society for the Prevention of Blindness, Inc., Office of Publication, 1315 Cherry Street, Philadelphia, Penna.; Editorial Office, 50 West 50th Street, New York, N. Y.

The Sight-Saving Review

Volume IX Number 1

March, 1939

Table of Contents

Development of the Normal Eye in Infancy and Childhood*

Willis S. Knighton, M.D.

OPHTHALMIC information which all pediatricians should take into consideration in the care of their patients.

ALTHOUGH the eye of the newborn child is completely differentiated into its various tissues and structures, it continues to develop throughout life. The whole physical structure at birth is about 70 per cent of the final size, and in the growth process various changes take place which have an important bearing on the functioning of the eyes.

Newborn Eye

The newborn eye is a short eye and the crystalline lens is nearly spherical. This has an important bearing on the refraction of the eye, as we shall see later. The anterior chamber appears deeper at the periphery, that is, in the angle, owing to the fact that the central part of the iris (at the pupil) is being pushed forward by the lens. The ciliary processes are small. The choroid and iris contain very little pigment. The vitreous chamber is of comparatively little depth. The medial half of the eye is less well developed than the lateral, so that the optic axis, a line passing through the centers of the cornea and lens, will strike the retina at a point between the fovea and optic disk. With development, this inequality disappears and the optic axis is displaced laterally until it reaches the fovea. The fibers of the optic nerve outside the eyeball are only partially myelinated and the process is not complete until about 10 weeks after birth. The nasal ducts of the lacrimal sac,

*Read before the Pediatric Section of the New York Academy of Medicine, December 2, 1938.

which are formed by the burying of a solid epithelial strand, ordinarily canalize at birth.

During the first few years of life the eye grows rapidly, the vertical diameter growing faster, so that the globe becomes more nearly spherical, and it reaches adult size at about the age of 8 or 9 years. As the orbits enlarge, and their temporal borders separate, the eyes get farther apart. The external rectus muscles thus act to greater advantage, and the internal to less, so that the eyes tend to diverge. It is interesting to note that the disparity before mentioned, between the optic axis and the visual axis, may give the appearance of strabismus where none actually exists. So also may the flat bridge of the nose and the epicanthus which occur in infancy.

The Lens

The lens continues to grow throughout life, and in a manner that is unique with epithelial structures. The cells on the posterior wall grow out as fibers reaching to the anterior lens capsule. Growth continues by apposition, but while in other epithelial structures, such as epidermis, hair, nails, the exfoliation of the oldest cells serves to maintain a state of equilibrium, no such exfoliation is possible in the lens, which is completely shut in. In this case compensation takes place by anteroposterior compression and a diminution in volume of the oldest fibers. Thus many zones are formed, often differing from each other in refractive index. These are the various "nuclei," fetal, infantile, adolescent and adult, according to the time of their appearance, but the nomenclature is at present lacking in uniformity.

Pupil

The pupils are small at birth and usually remain so until about the end of the first year. During childhood and adolescence they are at their maximum and gradually become smaller again until the pupil of advanced age is often quite small. At any one age the size of the pupil depends to a great extent upon the state of adaptation of the retina to light. A sudden increase in illumination will bring about a contraction of the pupil until the retina adapts itself to the new intensity of illumination, when the pupil will then gradually dilate to its normal physiological size. There are so many

other factors, however, which influence the size of the pupil that it is extremely difficult to isolate one and to determine its effectiveness.

Iris

The color of the iris is always proportioned to the pigmentation of the rest of the body. Dark races have a dark iris. The color of the iris depends upon the proportion between the pigment of the posterior layer, which is always abundant, and that of the iris stroma, which varies greatly. Most children are born with a blue iris, the color being due to the appearance of the posterior pigment layer as seen through a thin iris stroma, which has little or no pigment. The color changes during the first years of life as the stroma becomes thicker. If the thickened stroma contains no pigment, the iris appears gray; with increasing amounts of stroma pigment the iris appears browner. The transformation from blue iris to brown may be confined to one sector, or one eye may be blue and the other brown, but this latter heterochromia is usually pathological. Complete lack of pigment in both iris layers occurs in albinism and the iris appears pinkish.

The vitreous gel at birth contains very fine fibrils and vascular remains of embryonic vessels, but they usually disappear within a few years. The embryonic canal of Cloquet may extend back horizontally from the retrolental space to the disk but eventually sags down into the lower part of the eye by the fourth year.

The sclera is very resilient in youth and does not lose its elasticity until after adolescence.

Ocular Refraction in Childhood

The refraction of the eye at birth is comparable to that of terrestrial mammals in the natural state; the eye is adapted for vision at long distances with but little capacity for the focussing of near objects. The excessive shortness of the newborn eye, without some compensating factor, would make the incoming rays of light focus far behind the retina and would result in a hyperopia of about 24 D. But the infant's lens in its rounded condition is highly refractive and counteracts the tendency to hyperopia by converging the incoming rays, so that the hyperopia is seldom excessive.

As the child grows, the eye elongates, carrying the retina farther back, while the lens becomes flatter and less refractive, thus focussing the incoming rays of light farther back in an attempt to keep the image on the moving retina. The effect of the elongation is usually predominant, so that there is a progressive tendency of the growing child to lose its hyperopia and become more nearly emmetropic, an ideal condition in which distant rays of light are focussed on the macula in the relaxed eye. If the focus of these rays falls short of the retina, myopia results.

This tendency to elongate seems to be most active between the ages of 6 and 16, during which time the percentage and amount of hyperopia decrease, and myopia increases. After 16 the elongation of the eyeball is generally but little marked, and in the great majority of cases it ceases altogether by 20.

If an eye, therefore, is emmetropic at birth, *i. e.*, if distant rays fall directly on the retina, it is prone to become myopic as development proceeds. For this reason we like to see an eye in infancy with so-called "hyperopic reserve" so that the final refractive condition is not myopia, but emmetropia or slight hyperopia. Hyperopia is corrected in the eye by the act of accommodation which increases the curvature of the lens and converges the overshooting rays of light so that they focus on the retina. Infants and children are blessed with a very flexible lens and a great amplitude of accommodation, which can take care not only of all ordinary amounts of hyperopia for distant vision, but which also permit exceedingly close focussing for near.

According to Fuchs, about 5 per cent of infants are born myopic, 15 per cent emmetropic, and the remainder have a hyperopia of 1–4 diopters.

Public health surveys in the United States and Great Britain show a gradual decrease in the *average* refractive error from +2.5 D. at 2 years of age to +0.75 D. at 12 years.

Age	*Average refractive error under cycloplegia*
0 to 2 years	+2.5 D.
3 to 5 "	+2.0 D.
6 to 8 "	+1.5 D.
9 to 11 "	+1.25 D.
12 + "	+0.75 D.

From the same sources, the percentage of myopia was found to increase from 1.1 per cent at 2 years of age to 10 per cent in Great Britain but only up to 7.8 per cent in the United States, by the 12th year.

	Per Cent of					
	Hyperopia		Emmetropia		Myopia	
Age	*Great Britain*	*United States*	*Great Britain*	*United States*	*Great Britain*	*United States*
0 to 2	98.1	..	0.8	..	1.1	..
3 to 5	95.8	..	2.3	..	1.9	..
6 to 8	90.6	86.4	5.3	9.7	4.1	3.9
9 to 11	87.2	77.8	5.0	16.1	7.8	6.1
12 +	79.6	66.2	10.4	26.0	10.0	7.8

Little is known about the development of astigmatism. It is found early in life and probably, in many cases at least, is congenital. It usually shows no great tendency to change during the growth period, remaining about the same from childhood to early adult life. Astigmatism is due to differences in curvature of the meridians of the cornea or lens, thus producing a distorted image on the retina.

The question of vision and its development involves a consideration of many factors. During the first ten minutes of life, eyelid reflexes, due to the contraction of the orbicularis muscle, can be elicited by flashing a bright light before the child's eyes, whether his lids are open or closed. But the same response cannot be elicited by simulating a blow on the eye with the hand or other object, which can be interpreted as superior activity of the light response or lack of experience in avoiding blows.

It is not until 10 days after birth that a small percentage (9 per cent) of infants try to converge their eyes on a small light. This is the first sure indication of fixation movements, and, we may assume, of macular function. The macula at birth is only a shallow depression and does not attain its full development until the child is 6 months old.

Difficulties in Determining Refractive Errors in Childhood

Visual acuity appears to increase with age during the early years but this should not be interpreted as an increase in pure macular function. When we ask an individual to read letters on a chart we

are testing a number of functions. To begin with, we are testing the power of attention which in itself is complex, consisting of both the willingness and the ability of the subject to make a conscious effort to read. There is little doubt that this is one of the causes of our inability at times to get the best measurement of vision in children. In addition there must be the physical ability to direct and fix the eye so that an image of each letter falls in turn on the most sensitive part of the retina. Very accurate fixation is required to read the 20/20 line, where unfortunately it has been the habit to crowd a great number of letters on the line. It is doubtful whether very young children have the necessary co-ordination of the external ocular muscles to do this. Even though the child has perfectly normal eyes, he is still a novice in their use. His co-ordination is instinctive—not smooth and easy. He also has poor ability to analyze form patterns.

It is important to appreciate that age and psychology must be considered in establishing a rating of visual acuity. Various surveys have been made to determine the gradual rise in visual acuity with age, but the difficulty of getting a comprehensive and representative cross-section of children's vision is apparent in the discrepancies in the published results. U. S. Public Health Service figures show a gradual rise in the percentage of children with 20/20 vision, from 72 per cent at 6 years of age to 90 per cent at 17 years. Other tables with varying figures point to the conclusion that, as Doctor Hardy so aptly expresses it, "we learn to see by seeing."

Distant vision is most accurately tested on distance charts; small type held at the reading distance, although subtending the proper angle, is not adaptable as an accurate test of visual acuity.

Binocular Vision

According to Duke-Elder, binocular vision is a late acquisition in phylogeny and in man it can be acquired only post-natally. We have seen that an early fixation reflex is present which is maintained momentarily, showing that there is an innate predominance of the macular region. This, however, applies to each eye separately, and it is not until the age of 5 or 6 weeks that an infant will fix a light binocularly. For some time thereafter, however, the power of fusion is so feebly developed that frequent lapses from parallelism

of the eyes occur, and deviation occurs on the slightest excuse; but at 5 or 6 months, fixation begins to be maintained in spite of obstacles. Towards the end of the first year the eyes will make a considerable effort in the interest of fusion, and if the obstacle proves insuperable, diplopia probably results.

It has been assumed that there is a center in the brain where this fusion is brought about, just as one might speak of the center for speech or hand movements, etc. There is no anatomical or physiological evidence, however, that such a center exists apart from the visual cortex in the occipital lobe. Adler believes that what evidence there is seems to point to the establishment of this faculty in its fullest attainable form at birth, and questions the evidence of its growth by exercise. On the other hand, Duke-Elder says that the faculty of binocular vision is acquired, like that of all other habits, by a facilitation of reflex paths, such as is exemplified in the conditioned reflexes of Pavlov. It is thus built up upon an already existent basis by education, a circumstance which accounts for the varying degrees to which fusion may be developed in different individuals and improved in all individuals. This is a moot question; the probabilities would seem to be that fusion exists potentially at birth, that different individuals have different capacities for improvement, depending upon exercise and experience, just as different individuals can develop their appreciation of and ability in art and music, but cannot go beyond their own limitations.

Although in binocular vision the two eyes act as one centrally situated cyclopean eye, the habit becomes inbred in most individuals of relying to a greater extent upon one eye than the other. One of the two assumes the rôle of the master eye. When the two eyes are approximately equal in visual acuity there may be little evidence of dominance, but it may be demonstrated in some degree with suitably applied tests. The significance of ocular dominance is not by any means understood. The common statement that right ocular dominance goes with right-handedness has no foundation in fact although a certain tendency to this exists. Adults and children show similar proportions and these are maintained in races as widely different as Chinese and Americans. Little or no indication is available as to when the preference for one eye first shows itself in development or whether the habit is established as a result

of environmental conditions or tendencies of motor co-ordination, but all the evidence points to the fact that once established it can only with difficulty be reversed.

Evolutionary Development of the Eye

Considered from the evolutionary standpoint purely as an optical instrument, the human eye leaves a certain amount to be desired. Although it occupies a high place in mammalia because of its specialized area of acute vision, the fovea centralis, and its more adaptable refractive system, it is, however, not far removed from what one might call the basal type of vertebrate eye.

In birds and in carnivores we have an eye that is more nearly perfect as a percipient apparatus. One cannot, therefore, look upon the human eye as having played a great part in the evolution of man, but one must consider it rather as a fairly simple organ rendered extremely valuable, not by any degrees of structural specialization, but by the cerebral structures with which it is connected.

The Psychological Touch in Straightening Cross-Eyes

Meta Rosenthal

IN the treatment of cross-eyes, the parents and teachers as well as the oculist are responsible for preventing psychological complexes.

The Story of Fred

"Hello, doc! We've decided to let you operate."

"Operate? What do you mean? I haven't suggested an operation," answered Dr. X, looking at Mr. Smith in amazement as the latter walked into his office hurling the abrupt announcement into the air.

"I know you haven't, doc, but you did say you operate on cross-eyes when they're too bad to be straightened by exercises, so why shouldn't it be all the easier when they aren't so bad? The boy won't wear his patch unless his mother nags him, and that gets her all excited and nervous, and she says she's too busy to stay around and see that he does it—you know how it is with a woman: household duties, aggravation with the servants, entertaining—besides, on the level, doc, don't yo' think the treatments are the bunk, anyhow? I haven't seen much improvement since the kid's been coming here. And they mount up into money, too, so why not just operate and have it over with? Speed, doc, speed! We're living in the 20th century, you know."

Mr. Smith must have caught a dangerous gleam in the blue eyes of the red-haired oculist, for he stepped back from the window to which they had walked, on the twelfth floor of the building in which Dr. X's office was located.

"Aw, doc, look, I didn't mean any offense. Truth is, I'm trying to get away from that everlasting wrangling at home. My wife

says the boy's old enough to come in from play of his own accord and cover his eye. The boy promises before he goes to school, and in the afternoon, when he's playing with the rest of the kids, he forgets all about it, and by the time I get home, the war's on. It's been that way ever since we brought him down here. Can't you see, doc, what I'm up against?" Mr. Smith let out an expressive "WHEW!" and flopped his large frame into a chair.

Dr. X did see. And although the request from the father was extreme—to perform on his son an operation which wasn't indicated—the domestic situation, unfortunately, was not an unusual one.

About six months previous to the above discussion Fred, Jr., at the age of twelve, had been brought to see Dr. X. An eye examination revealed that he was astigmatic; and that the vision in his two eyes was unequal, with considerably less than normal sight in the right eye, which also had a decided "squint." The oculist impressed upon the parents (or thought he had) their good fortune in that Fred's eyes, for which glasses and developmental exercises should have been prescribed at a much earlier age, could still be straightened and the sight developed, without resorting to an operation.

The boy took delightedly to glasses, and came to the oculist's office for prism and other kinds of exercises. At home each day, for a prescribed period of time, he was expected to wear a patch or opaque lens over the eye that had the good vision, so that the "poor eye" would be forced to function. Otherwise, in order to avoid double vision, he would suppress the image in that eye which, from lack of exercise, would in time become a blind eye—at least as far as serviceable vision was concerned. Dr. X stressed, also, the fact that an adolescent boy is naturally restless and impatient, and urged that either parent occasionally join in the task or play assigned for such hours. He cautioned, specifically, against expecting Fred, Jr., to wear the patch at school where he would encounter brutal teasing from savage young schoolmates. This, however, was exactly what his mother did expect, since it would relieve her of responsibility. Consequently, every evening upon Mr. Smith's arrival home, nagging, scolding, arguing, were in full swing and an operation seemed the only means of escape.

Resenting the reference to fees by a wealthy man whose financial status had not been taken advantage of; the thwarting of his professional skill to accomplish results despite the handicap of Fred, Jr.'s, age; and, above all, the danger of physical hazards to the boy and future mental inhibitions, which his experience had taught him to anticipate, Dr. X expressed himself in no uncertain terms. It terminated both the discussion and Fred, Jr.'s, visits to the office—and as far as the office was concerned, he was completely lost track of for nine years. Then, one morning, a tall, manly looking chap called to see Dr. X. The latter looked at him—there was a moment's hesitation—and the tell-tale eye effected the recognition. Fred flushed painfully.

There was a genuine get-together and then came the story—so tragic and so like most stories of its kind, varying only in details. The unpleasant scene which developed between his parents after Dr. X had refused to operate resulted in complete neglect of the boy's eyes; and the turned-in eye, which previously had been only a source of annoyance, henceforth became the nucleus of an ever-widening circle of psychic conflicts. A naturally sociable and normal boy began to shrink painfully within himself, which carried over into his college life. In his senior year he fell in love with a pretty co-ed, but hadn't the courage to believe that her apparently reciprocal interest was other than a sympathetic one because of his "disfigurement." There followed weeks of bitter introspection—then, suddenly, a flash of hope. Dr. X—an operation—if only it weren't too late!

It was too late—as far as the ability to restore sight to the eye, now practically blind. Cosmetically, the operation was a triumph. Psychologically—it meant years of determined re-education of the mind and will to overcome a distorted self-consciousness.

The Story of Mary Ann

Mary Ann's lithe little figure, sparkling blue eyes, and blonde bobbing curls would all dance into the room together—for Mary Ann never walked. Hat and coat pulled off and thrown unconcernedly on the nearest chair, she'd make straight for Dr. X, who usually sat at his desk awaiting the entrance of his patients. Taking hold of his hand, she'd burst into an account of her latest

experience, which she always relived, vividly, in the telling; and young as she was, she possessed a magnetic persuasiveness that swept you right into her mood. Her blue eyes would grow bluer and bluer, and open wider and wider, and then, suddenly, the left eye would turn in so sharply and unexpectedly that to one who witnessed it for the first time it appeared as though something had snapped in the orbit. Invariably, the muscular contraction was a shock to the child as well as to the observer. She'd stop short in her story; over her little face there'd slowly creep a flush of embarrassment and humiliation, and in a moment she was transformed into a self-conscious, listless child, who went through examination and exercises without a word. Within an hour she'd forget all about it, of course, and be on her way, sunny and sparkling as ever. That was Mary Ann at six.

The following year her family moved to another city, and soon dropped all correspondence with Dr. X.

At sixteen she returned with the same suddenness that Fred, Jr., had come back the previous year, and with a heart as full of trouble. Her mother, although kind and companionable, had an utterly irresponsible attitude toward everything that involved regularity in time and performance. Censuring herself during the years for neglecting Mary Ann's eyes, she, nevertheless, continued to neglect them, a condition the girl thoughtlessly accepted until she was entered in a fashionable finishing school. Then—the shock!

During the weeks that followed the operation (both sight and muscles responded favorably), one sensed, despite the girl's unfailing sweetness and respectfulness toward her mother, an unmistakable attitude of rebuke which she tried desperately to hide.

Care of Cross-Eyes

However, for every case of neglected cross-eyes (strabismus) there are many cases which receive solicitous and conscientious care. The process is a tedious one, necessitating daily attention and extending, often, over a period of years. But care alone is not sufficient. It must be the right care. As soon as the cross-eyes are discovered, the child, even if still a mere baby, should be placed in the hands of an oculist. In the oculist's ability to make a scientific diagnosis of the condition of the eyes, the source of the error, and

the correct and effective manner in which to treat them, lie the safety and successful outcome of those eyes.

According to the best medical consensus, glasses are prescribed in most cases of cross-eyes. Developmental exercises are invariably a part of the program; for although the visual error may be slight, lack of muscular co-ordination between the eyes is apt to induce a child to suppress the image in the eye that has the lesser sight, in order to avoid "seeing double." If the inactive eye remains dormant too long, there is danger of permanently impaired vision in that eye—even blindness, if, as in the case of Fred, Jr., the sight is poor at the outset.

Each case of cross-eyes is individual and should be scientifically treated as such. Yet innumerable otherwise intelligent parents have been lured (although in decreasing numbers) by the "cure-all" promises of charlatans who hypnotize them with magnetic slogans such as "Throw Away Your Glasses," "Cure Cross-eyes via the Natural Way," etc.

The desire to counteract these pernicious practices undoubtedly has been one of the influences that led to the establishment of scientifically conducted orthoptic clinics. These clinics are in connection with hospitals, universities, and eye infirmaries throughout the country. Their staffs are comprised of oculists, who are assisted by "orthoptic technicians." The latter are trained in physiological optics, anatomy, refraction, psychology, and in other related subjects. Certain clinics treat only children; others admit both children and adults. In either instance the patient must have been examined by a medical member of the staff or by an outside oculist. A few of the clinics charge fees, which are dispensed with if paying them imposes a hardship on the patient or the patient's family.

Orthoptic Exercises

We are told that corrective and developmental exercises in the large majority of children's cases, if begun early enough, will straighten the eyes and develop the sight to the maximum of each child's ability to see. If, however, upon clinical examination, there is doubt as to the efficacy of exercises in a particular case, tests are made to determine whether they or an operation is required. No false hopes are held out, or dangerous formulas, like "Throw Away

Your Glasses," advocated, although there are occasional cases of cross-eyes which glasses do not help to correct. Intensive, systematic investigation is going on at the present time to determine the exact effectiveness of orthoptic exercises upon the muscles of the eyes.

Most oculists still prefer to treat their cases of cross-eyes in private practice. Whether that be the procedure or whether they send them to clinics, they are agreed that it is vitally important to prevent a sense of inferiority from creeping into the minds of their patients, which is likely to occur because of the physical handicap.

In the ideal clinic it becomes the duty of the technician to plan "homework," when recommended, in relation to a boy's or girl's favorite studies, play, hobby, or what not; the object being, of course, to transform trying minutes or hours into absorbing occupation. If the only instruction for home treatment is to cover the good eye, it is wise for the person who has charge of the child to provide an interest. It should be selected with consideration not only for the discomfort of having one's sight restricted to its minimum capacity, but for having to make the eyes function concentratedly. It is well to be understanding, particularly, during those unstable adolescent years when the days seem entirely made up of positive discipline at school, and incessant "don'ts" at home. This doesn't mean that an adult need enter into every period devoted to exercises. An engrossing occupation, an occasional word of encouragement, or hour of enthusiastic companionship, usually suffices to convert the irksome duty into pleasurable pursuit. There is bound to be occasional rebellion. An adult would not be above it.

Co-operation of the Mother

The mother—it is usually she who is called upon—who is impatient with her part of the discipline, or who is bored at the idea of entering into her child's mental world, might take heart by reading an article entitled, "You Might As Well Enjoy It." In it, the author, William Moulton Marston, says, in reference to our bored attitudes toward other people's enthusiasms, "Boredom may be the raw material of pleasure," and suggests, "Dive into the topic mentally, try to master it yourself, and you'll find your-

self enjoying it." This approach may be encouraging, also, to the boy or girl who has no inherent preference for a topic, occupation, or sport. Who knows? Many a physical handicap, and one much worse than cross-eyes, has been the means of firing the imagination to venture into unexplored channels of thought or endeavor, which have led to a stirring life's work or to a fascinating avocation.

Don't Criticize Glasses

Another suggestion to mothers is that they refrain from making disparaging comments within range of their children's hearing regarding the effect of glasses upon the latter's looks. A thoughtless remark, such as, "Glasses simply ruin Susan's looks," has been instrumental in accomplishing that very thing because it has made Susan "feel under"; whereas, accepted naturally, glasses would have heightened her expression, through providing her with comfortable or clearer vision. Besides, the point of view is old-fashioned, to which our swanky and most ultra fashion journals will testify. Just recently they have proclaimed that grimaces and nervous manifestations occasioned by strained vision are far more devastating to good looks than glasses. Surely, two bright, straight eyes, sparkling through glasses, are more flattering to a child's appearance than eyes that are out of focus.

If a boy objects to wearing glasses, let him select a frame that is similar to the kind worn by one of his heroes (provided, of course, it is mechanically correct) and his opposition will quickly melt away. An appeal to the little daughter by demonstrating that they improve her looks; the shopping tour, enlivened by creating an interest in the subject, such as is exhibited in the purchase of a dress or toy, and the trick is almost certain to be turned in favor of the glasses. In each case, they should be spectacles.

Conclusion

A diagnosis by an oculist, and faithful co-operation with him; winning the boy or girl over, through pleasurable occupation, to acceptance of the discipline, and there need be no more loss of sight because of neglected cross-eyes; no unnecessary operations; no heartaches and disillusions; and, above all, no psychological conflicts, such as developed in the cases of Fred, Jr., and Mary Ann.

Sight-Saving Classes

Professor Dr. M. Bartels

An Excerpt from the German*

Translated by Hildegard Lawler
Edited by Harry S. Gradle, M.D.

THE similarities as well as the differences in sight-saving classes abroad and in America are brought out in this article, translated from the German.

WHEN classes for the physically handicapped are requested, one invariably receives the reply that the money could be better spent by using it exclusively for normal children. That this answer is absurd and superficial in the case of sight-saving classes, I hope to be able to prove. The omission of such classes is much more costly than their installation.

How Did Classes for Low-Visioned Children Originate?

Teachers in schools for the blind were the first to point out this need. As early as 1802, in Austria, Von Gaheis wrote:

> "By enlarging the Institute for the Blind, there could be a department for the partially blind where these children could be trained to make the best use of what eyesight they had left."

Rektor Herzog of Berlin once said:

> "To be blind always means a certain dependence. But this is not permitted to children with low vision as long as they have a fraction of sight left. These children in a school for the

* The original article by M. Bartels of Dortmund appeared in the *Klinische Monatsblaetter für Augenheilkunde*, August, 1938. A free translation was published in the *Journal of Social Ophthalmology* (Paris), November, 1938. As the latter has but a limited circulation in the United States, it was thought that a free translation of certain applicable parts of the original, published in the REVIEW, would be of interest and value to the subscribers.

> blind naturally feel themselves superior to the totally blind and constitute a disturbing element in the classroom. To be sure, they can serve as leaders. In doing this they probably lighten the work of the teacher, they help the blind children, but they do not learn to utilize the remnants of their own sight."

Teachers of the blind have also called attention to the fact that low-visioned children who graduate from a school for the blind are stigmatized as blind all their lives and naturally this hinders their advancement. It is difficult to transfer a child who has been educated in a school for the blind back to regular school work since the methods employed are so different. Instructors in schools for the blind are fully aware of this problem. Dallberg, at the Congress for the Blind in Königsberg, 1927, said that the establishment of special classes for low-visioned children would relieve the Institute for the Blind and other welfare agencies dealing exclusively with the blind.

If, on the other hand, a child with low vision is left in regular school, he is retarded, because the teacher has too many children under his supervision to give special attention to this child. Sometimes the parents can help, but in the majority of cases the child's work suffers, he develops an inferiority complex, he fails to develop mentally, he often has to repeat grades, and becomes the laughing stock of his school fellows.

Children are cruel and often make fun of those with poor eyesight. When those with low vision graduate they are inadequately equipped for life and become burdens on society. It is therefore of the greatest interest to the State to educate this group of children as adequately as possible.

We must always stress the fact that a sight-saving class is a school for normal children and that many children may be transferred back to regular schools after sight is improved, or the disease endangering their eyesight has been cured.

From the purely financial standpoint, sight-saving classes are more expensive than regular classes; but in the long run, they are a saving of money. Furthermore, sight-saving class children may be trained for many occupations from which the blind are barred. This has been proven by the graduates of schools for the low-visioned in Berlin and Dortmund. This method of education re-

duces the cost of relief and, what is very important right now, increases the number of employables.

Who Are the Partially Seeing?

An absolute definition for partially-seeing children does not exist. We do not even have such a definition for "blind." The decision as to what children qualify for this group should be fixed by the ophthalmologist and the school authorities acting together, never separately. We can accept with reservation the definitions adopted unanimously at the Congress for the Blind in Königsburg in 1927:

> "A child is practically blind and should be educated in a school for the blind whose vision is from 0 to 8/200 . . . ."
>
> "A child is partially-sighted and should be educated in a sight-saving class when he has vision from 8/200 to 20/80, provided the vision is sufficient to learn reading and writing under the safeguards which sight saving furnishes and provided it is sufficient to make practical further education for a profession or occupation followed by seeing people.
>
> "Supplementing the above we add that beside visual acuity, fields, color sense and near vision must be taken into consideration when defining this class of children."

Experience proves that children with as little as 4/200 can learn to read and write in sight-saving classes. The entire make-up of the child must be considered—his mental and physical equipment —but it must be remembered that even retarded children have made satisfactory progress once they were placed in sight-saving classes. Furthermore, the helpfulness of the parents and the family background influence these cases. In borderline cases the school should make the decision after due trial.

Besides children with reduced vision, those with endangered vision must be considered. This group includes children who suffer permanently from some pathology of the eye and who, therefore, as the English authorities have discovered, are truants from school for years. Examples of such cases are children suffering with keratitis parenchymatosa, chronic trachoma, scrofula, etc. Naturally these children, because of their long absences from school, become retarded. This group should be placed in sight-saving classes temporarily. Here in Dortmund we include the highly myopic with

those who have endangered vision. Children who, on entering school, have eight or more diopters of myopia should be referred to sight-saving classes; also, children who have lesser degress of myopia but who come from families where there is a history of myopia. With this group of children who have "endangered vision" it is not a question of visual acuity but a mechanism whereby further damage to the vision may be prevented by special instruction.

England and America go much further than we do, and in these countries children with four diopters of myopia are referred to sight-saving classes. In a recent report of the National Society for the Prevention of Blindness cases were cited where children recovering from general sickness or one-sided enucleation, or suffering with nervous asthenopia, were placed in sight-saving classes. This I consider to be superfluous. On the other hand, we should consider sending children with amblyopia due to strabismus to sight-saving classes as long as the good eye is bandaged.

We wish to mention here the regulations laid down by the Board, elected for this purpose:

"1. We hope to send back to regular schools as many as possible.
"2. The establishment of sight-saving classes is feasible only in large cities or their immediate neighborhood, and not for purely rural areas. Children from these areas may be placed as boarding pupils in sight-saving classes or in the Institute for the Blind, at the discretion of the authorities, each case being judged individually.
It is not considered advisable to put sight-saving classes in schools for the blind.
"3. Children who cannot progress in the ordinary classroom should be put in sight-saving classes. In this group we consider the following:

(a) Eye diseases.
Lower limit of visual acuity—8/200 with normal visual fields and a normal intellect.
Certain intelligent children whose visual acuity is below this limit may be exceptionally admitted, on trial, once their visual defect has been corrected.
Upper limit of visual acuity—20/80.
Mentally defective children are excluded. Children who have great difficulties in learning to read or write may be admitted with the poorly sighted.

(b) Systemic diseases (children with a threatened eyesight). The decision rests in each case with the oculist. To this group belong all cases of chronic relapsing diseases of the anterior and posterior segments of the eye. Oculists should endeavor to identify these cases among the children under their care. Eventually one may temporarily admit these cases in a sight-saving school during the active stage of the disease and send them back to the ordinary school once they are improved or cured.

(c) Refraction errors (in these cases the decision rests with the oculist).

The following belong to this group: (1) Myopia exceeding eight diopters progressive, hereditary, in children in whom an aggravation has been observed; and (2) other marked refraction errors after an estimation of the visual acuity."

How May the Partially Seeing Be Found?

This is not simple because there is great ignorance on the subject and little enthusiasm for it. The co-operation of ophthalmologists, teachers, parents, and authorities is imperative. The eyes of all school children should be examined. In Dortmund, the school board requires the teacher to submit on special forms a list of all children suffering with eye trouble. The school doctor then examines all children, paying special attention to the children on this list. His recommendations are reviewed by an ophthalmologist who does not treat the children but who states the findings and refers the children to their own ophthalmologists for treatment, refraction, etc. According to our experience, many more children are referred to sight-saving classes than really qualify; for instance, in Dortmund 500 children were listed as possible candidates but only 39 were actually eligible for placement in sight-saving classes.

It is highly necessary that a complete list of the younger children be submitted by the school doctor because early discovery and placement in sight-saving classes are important.

After the ophthalmologist decides that the child is a candidate for the sight-saving class, he sends him back to the school doctor with a regulation form properly filled out. The school doctor then examines this child for other physical or mental disturbances. Contact is made with the parents and their consent is gained for place-

ment. The child is then given a thorough pedagogical examination by the sight-saving class teachers.

Besides this, ophthalmologists generally are urged to refer to sight-saving classes children of low or endangered vision whom they discover through their private practice. Unfortunately, there is indifference at times and this militates against the interests of the children.

I have already stressed the fact that here, as in America, only mentally normal children are referred to sight-saving classes. These schools are not for the subnormal but for the normal. The sight-saving class demands more mental exertion than a class for normal children. The fact must be recognized, however, that often children of normal mentality appear subnormal because of their retardation on account of low vision, and therefore experimental placements of this group are justified.

There is justice in the demand of Herzog of Berlin that, without reference to the attitude of the parents, the placement of children who are rated as sight-saving class pupils should be compulsory in the interests of the common good.

The expression "sight-saving classes" is official in America only. In England these classes are called "schools for the partially sighted." The parents and children feel that this name removes the stigma attached to the handicap and minimizes the difficulties which might be encountered on leaving school. These classes might also be called "classes for visual re-education." However, as I said before, I believe that the term sight-saving class is the best because it implies that it is to the child's best interests to be in the class and the parents will understand this and be more co-operative.

How Many Partially-Sighted Children Are There?

There is a remarkable similarity in all civilized countries in the proportion of sight-saving class pupils to the total number of children. If we take into account only those with very low visual acuity, the proportion fluctuates between 0.3 and 1.2 to every 1,000 in all countries. If we know the total school population, one can easily estimate how many would be eligible for sight-saving classes.

As far as I know, Japan is the only country at present where an estimate has been made, by a national census, of the number of chil-

dren who are partially sighted. The total school population in Japan in 1934 was 7,366,028 and the number of low-visioned children was 9,023, or 1.22 per 1,000. It is also interesting to note that the number of low-visioned children increases with the grades. In the sixth grade there were three times as many as in the first grade.

Which of the Plans for Sight-Saving Classes is Considered Best?

There are three different kinds of classes: (1) Sight-saving classes in schools for the blind; (2) the English and American systems, where partially-sighted children are educated with normal children with the exception that certain subjects are taught under the special conditions and methods adopted for the partially sighted; and (3) the system where whole schools are given over to sight-saving class work.

Sight-saving classes in schools for the blind are certainly the worst solution, since instruction for the blind is absolutely different from instruction for the partially seeing. Low-visioned children who attend a school for the blind are stigmatized their whole life long as blind.

The Anglo-American system has the advantage of keeping the partially-seeing children with the normal child. It is supposed that inferiority complexes are avoided by this.

Our experience has been that children who attended our separate system have never developed these feelings of inferiority. It is to be noted that in both American and English classes many myopes who do not have low vision are placed in the classes, while here in Germany we have only actually low-visioned children or children with endangered vision.

A very important item is the fact that teachers must be trained. Our Dortmund teachers had a year's training in Berlin, followed by an examination. The heavy duties incidental to this work demand particularly fine qualities of personality and character, plus devotion to the cause.

What Are Results?

Remarkable results have been obtained in all countries. Children who were retarded in the ordinary school progressed fully in the sight-saving class. The children enjoy their work so much

in these classes that they are loath to return to the regular school when their sight improves.

There are sight-saving classes in North America (including Hawaii), Argentina, Belgium, Brazil, Denmark, England, Holland, Scotland, Switzerland, Hungary, Palestine, and France. Classes are contemplated in Australia, Bulgaria, Finland, Portugal, Lithuania, and Tasmania.

In pre-war Germany the first school was established in 1911 in Strasbourg. At the present time there are schools in Berlin, Dortmund, Essen, Leipzig, and in Chemnitz and Hamburg. There are schools annexed to the School for the Blind. The systems in North America and England are the best developed. In April, 1938, there were 571 sight-saving classes in the United States. In the United States these schools are recognized by law in 20 of the 48 states. In many cases state support is provided. In England and Scotland the schools are supported by government grants.

Conclusion

In conclusion these facts must be considered. Either sight-saving classes are unnecessary and, in that event, we should close the existing ones; or they are necessary, in which case they should be systematically fostered. That they are necessary and beneficial has been proved in many countries. I hope I have proved that the cost yields big dividends. There is no doubt that institutions for the blind are far costlier.

Since sight-saving classes are necessary, the disparaging of them should cease and the State should adopt a systematic course of procedure. Stupidity and ignorance must be overcome. It might be best to start first in the large cities, because they furnish better conditions for demonstration. Later the smaller cities and rural districts can be regulated.

It is curious how extraordinarily well the blind are cared for by the State, while the partially sighted are not. It is illogical to care for the blind and ignore the partially sighted. Surely the welfare of the blind should not be neglected, but it is much more important to the State to care for the partially sighted, especially since this constitutes a much larger group.

The College Student and Dormitory Study Facilities*

Anette M. Phelan, Ph.D.

EMPHASIZES the necessity for a continuous program of eye health during the college age, and presents a description of reading and study facilities conducive to good eye health.

OF THE one and one-half million students in colleges and universities today, probably the majority entered with the intention of completing the four-year course of study. Those who find satisfaction and success in college work will graduate, but others will drop out all along the way. The loss in time, money, and courage is serious. Any factor influencing the success of students merits consideration, alike by the faculty and the student body.

Good Eyesight Essential to College Education

In the present college curricula, successful achievement is largely conditioned by the student's ability to receive mental stimulation from the printed page. In college the student finds keen competition and a responsibility for self-directed study for which he is not always prepared. To secure and maintain a standing in college, he must read more than he has ever done before, and the reading must be effective. Rereading of material takes time which could be devoted to other assignments.

Good study habits are essential to college success and can be learned. Certain factors more than others influence this learning. Proper and adequate instruction in study methods, the student's desire to learn and his willingness to work, are important. No less important are the student's eyesight and his use of light as an aid to vision.

* For the Eye Health Committee of the American Student Health Association.

The college student who understands the part good vision plays in college achievement is likely to discover, before college entrance, just what the status of his vision is and how he may safeguard it. For such students, a complete eye examination by an eye physician (ophthalmologist), proper correction of refractive errors when present, and the physician's recommendations for care of the eyes, probably constitute a minimum for college work.

In all likelihood the eyes of the entering student are not fully matured, and the heavy eye load during the early years of college life may result in strain and fatigue. It is possible to reduce the amount of both strain and fatigue through a discriminating selection and use of light as an aid to vision. While light is by no means a substitute for ophthalmic supervision, its proper use is important, since the improper use of light constitutes a handicap even for the student with normal, healthy eyes. The facts on light and vision are few and relatively simple; their application to the study situation will go far toward the reduction of fatigue and discomfort.

Good Lighting an Aid to Seeing

The object of lighting is to facilitate seeing. It is not enough that the illumination be such that eyes can see the work: it should provide for a maximum of speed and a minimum of errors, fatigue, and discomfort. According to some research authorities, efficient speed and accuracy in seeing call for an intensity of not less than ten foot-candles (ten times the intensity of illumination given by a standard candle to a surface one foot distant).[1] In the practical application of research findings it is well to keep in mind the fact that laboratory tests are made under controlled conditions. In the tests on light and visual efficiency, the conditions include a test object of a given color and size, and a strong contrast in brightness between the object and its immediate background. For example, black printing on a white background provides a strong contrast in brightness, and hence is more easily read than the same printing on a colored background; and large type is more easily seen than small type. In college texts and study materials, both size of type and the color of background tend to vary. An increase of intensity of illumination on the page will increase the contrast between the printing and its background, and will also aid in discriminating the

Figure 1.—Use of the lamp in a single room. The student is right-handed, so the lamp is placed at the left and just behind the shoulder line.

Figure 2.—Position of the lamp in a double room where the lack of space necessitates the staggered use of the desk. Each student receives adequate light; the light source is so located that each is protected from glare; and a large surface of the ceiling is well lighted, thus providing good diffusion and good general illumination.

details in small type. There appears, however, to be no value in excessively high intensities.

The minimum intensity recommended in "American Recommended Practice of School Lighting," namely, 15 foot-candles, appears to be adequate for the ordinary reading done by students.[2] This intensity may also meet the needs of students with astigmatism (irregularity in the curve of the cornea or lens). Astigmatism interferes with efficient vision and contributes to discomfort and fatigue. The increase of intensity of light on the page or work reduces the influence of astigmatism.[3]

Vision for detail is improved when the general illumination is slightly below that on the page or work.[4] It should never be less than one-fifth of the page illumination. With the use of a light meter, which should be available on any college campus, the student may determine whether he is working with adequate light, and whether the relationship between the general room illumination and the desk illumination is suitable for efficient work.

Intensity is by no means the only lighting consideration, nor is it the most important. Eye comfort and eye health require suitable quality and distribution of light. For example, the quality of daylight is such that the human eye responds to it more favorably than to artificial light. This is due to the selective sensitivity of the retina to different wave lengths. For the same reason, the Mazda lamp is more comfortable for ordinary purposes than the so-called "daylight" or blue bulbs.[5]

In eye health and efficiency, distribution of light is very important. This factor deals with such considerations as glare, strong contrasts, shadows, etc. Glare has been defined as a "bright light in the wrong place."[6] The wrong place is within the field of vision. A bright light within the field of vision of the worker interferes with his visual efficiency; the brighter the light, the greater the interference.[7] Moreover, bright rays of light striking the eye have a cumulative effect of strain and fatigue.[8]

Eyes require well-diffused light from a large source. Concentrated light sources of high brilliancy, even when not within the field of vision, tend to favor specular glare (reflected glare from the page or desk)[5] and contribute to strain. Indirect illumination reflected from a large light-colored source (an ivory or light cream

ceiling) is more conductive to eye efficiency and eye comfort than is a direct light. In indirect illumination, the ceiling of light color becomes the secondary source, and the light reflected from it is well diffused, especially when the reflector and wattage used illuminate a large surface on the ceiling, and when the walls are also light colored. The importance of securing a well-diffused light can hardly be overestimated.

Dormitory Room Lighting

The foregoing facts on light as an aid to vision may be applied to many types of environment. The present consideration is limited to the college dormitory situation, for in this environment a large part of responsibility rests upon the student himself. Even in colleges in which the administration provides good rooms and adequate lighting facilities, the arrangement of lamp and desk usually is left to the individual student.

College dormitory rooms vary in size. Hayes gives the range in area as follows: single rooms, 100 to 160 square feet, with a ceiling height of about eight and one-half feet; double rooms, 200 to 279 square feet, with ceiling height of nine feet. In such rooms, with cream walls and ivory ceilings, adequate, well-distributed illumination can be secured through the use of a study lamp constructed according to the specifications on page 34. The height of the lamp and the use of the reflector (glare-reducing bowl) tend to reduce the possibility of specular glare. The diameter of the reflector, and the wattage of the recommended lamp, favor the lighting of a large surface on the ceiling, thus providing good diffusion. Contrasts in intensity between different areas in the room are reduced, and the desk illumination is not more than five times as great as the general illumination. The specifications herein offered were developed from the use of the regular I.E.S. student lamp in many dormitory situations. The floor lamp type selected has an advantage over the table lamp in that it can more easily be placed outside the field of vision.

The provision of a good lamp in a dormitory room does not solve the lighting problem. The proper use of the lamp is essential; so is its care. The photographs and diagrams in this paper illustrate the placement of lamp and desk to provide adequate illumination

on the work and at the same time safeguard the student from glare.

It is well to remember that the continued efficiency of the lamp depends upon maintenance of a clean reflector and upon replacement of the bulbs when needed. In replacing a broken reflector or bulbs, the following facts should be kept in mind:

(1) Standard reflectors of a given diameter have the same density; the reflector specified for the new student lamp on page 34 has a density that calls for a 150-watt bulb.

Figure 3.—Position of the lamp in a double room with desks arranged for two right-handed students. As in Figure 2, the students are receiving adequate, well-diffused illumination, and are protected from direct glare by the arrangement of desk and lamp which keeps the light source behind the left shoulder of each.

(2) The use of a reflector of smaller diameter results in glare; the density of the reflector with greater diameter reduces the intensity of light on the working surface.

(3) Likewise, bulbs of lower wattage used with the specified reflector reduce the level of intensity on the working surface, and bulbs of higher wattage tend to increase glare.

Individual desks are desirable, not only because they facilitate

the proper use of light, but also because they are an aid in reducing distractions for the student. The preferred desk is the flat-top type, with a working surface of not less than 30 by 40 inches, with a dull surface. The highly polished top reflects light and results in specular glare.

When assignments call for reading material printed in small type or for the transcription of pencilled or longhand notes, the use of a book rack (illustrated in Figures 2 and 3) makes it possible to tilt the book or paper at an angle that increases the level of intensity on the page, which increases the contrast between the background and the printing or writing, thus making the page more easily read.

Good Study Facilities for a College Dormitory

Recommendations of the Eye Health Committee of the American Student Health Association, in co-operation with the National Society for the Prevention of Blindness, for good study facilities for a college dormitory are as follows:

The Room.—Ceiling, white; walls, light tones; both in dull finish—no high polish.

The Desk.—Individual; size of top: not less than 30 by 40 inches; surface: dull finish (does not mirror light); blotting pad: soft tones—brown, green, blue; book rack: dull finish, of firm construction.

The Reading Chair.—The chair used with satisfaction by college students is usually a low, easy chair of approximately the following dimensions: Height of back, 36 inches; height of seat, 17 inches; depth and width of seat, about 21 inches; depth of chair from front edge of arm to the back of the chair, 30 inches; depth of arm rest from front edge, 10 inches.

Illumination.*—Intensity on working surfaces: 10 to 20 foot-candles.† General illumination not less than 1/5 of desk illumination.

Glare Control.—Lighted bulbs, mirroring surfaces, and deep shadows kept outside field of vision.

* Note specifications for student lamp on page 34.

† The desk surface near the lamp described on page 34 receives more than 20 foot-candles, while the further edge of the working surface receives more than 10 foot-candles; 15 foot-candles would be produced on a horizontal plane at desk level within three feet of the shaft of the lamp, thus providing on the printed page the amount recommended by "American Recommended Practice of School Lighting."

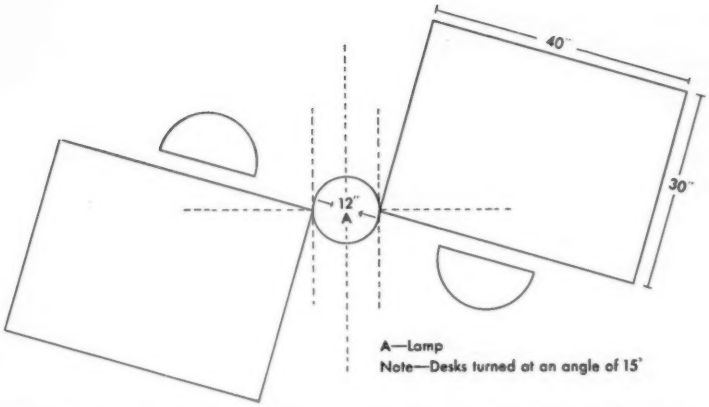

Figure 4.—Desk and Lamp Arrangement for Two Right-handed Students

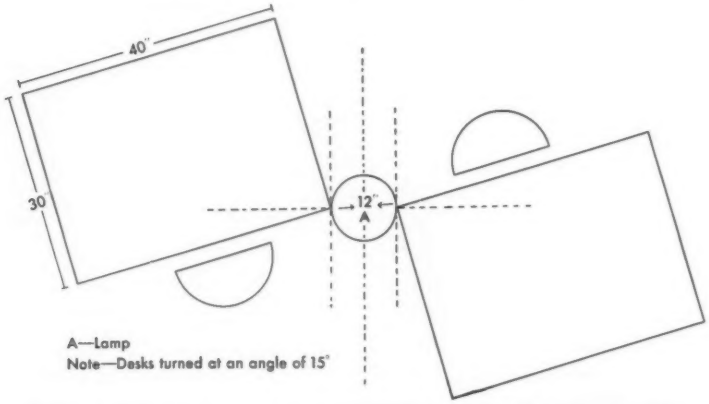

Figure 5.—Desk and Lamp Arrangement for Two Left-handed Students

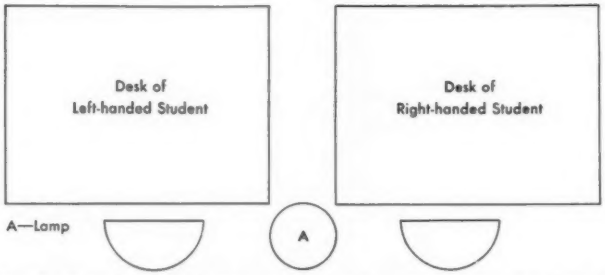

Figure 6.—Desk and Lamp Arrangement for Two Students—One Left-handed

Glare Hazards to be Avoided.—Uncovered light bulbs; direct ceiling light; goose-neck lamps on the desk, resulting in bright circles, dark shadows and sharp contrasts; table lamps, decorative or otherwise, within the field of vision, especially where the height of the filament from the desk top produces specular glare; shiny or glass-covered desk surfaces causing specular glare.

Use of the Lamp.—(1) Place the lamp just outside the field of vision; i. e., just behind the shoulder line. If left-handed, the student will get better service from a lamp set just behind the right shoulder; and (2) the reading chair should be turned so that a clear light falls on the page from a point just behind the shoulder line of the reader.

Student Lamp—Floor Type

The following specifications for a floor-type student lamp were prepared with the assistance of William Little, in compliance with I.E.S.* specifications, and with the approval of the Advisory Committee of Ophthalmologists for the Eye Health Committee of the American Student Health Association in cooperation with the National Society for Prevention of Blindness.

Standard.†—Strong, firm, maintaining vertical position; height: 60 inches from floor to light center; base: diameter, 10 to 12 inches; weighted to prevent tipping.‡

Reflector (Glare-Reducing Bowl).—Type: certified I.E.S. specification reflector; brightness—not more than 3/c per square inch; diameter: 9⅜ inches.

Shade.—Type: parchment or other material approved by the I.E.S.; diameter: upper rim, 9½ to 10 inches; lower rim, 23 to 24 inches; depth: diagonal, from upper to lower rim, 12 to 13 inches.

Lamp.—150 watts.

Intensity.—Minimum of 15 foot-candles within a circle having a six-foot diameter.§

* I.E.S. refers to the Illuminating Engineering Society.

† Experience indicates that a lamp cord 12 feet in length obviates the need of an extension cord in the usual dormitory room. This lamp has an open top and collects dust rather rapidly. Frequent cleaning should be arranged for, as dust tends to absorb the light and to cause depreciation.

‡ The base and standard should weigh not less than 16½ lbs. to prevent the lamp from being easily tipped over.

§ See footnote† on page 32.

References

1. Ferree and Rand: "Relation of Size of Pupil to Intensity and Speed of Vision." *Jour. Experimental Psych.*, XV: 37–55. February, 1932.
2. Illuminating Engineering Society, "American Recommended Practice of School Lighting." New York: I.E.S. 1938.
3. Ferree and Rand: "Intensity of Illumination Influencing Radial Tests for Astigmatism." *American Jour. Ophthalmology*, XII: 809. October, 1929.
4. Lythgoe, R. J.: "The Measurement of Visual Acuity." *Reports of the Committee upon the Physiology of Vision, Medical Research Council*, X: 31. London: His Majesty's Stationery Office, 1932.
5. Lancaster, W. B.: "Lighting Standards." *American Jour. of Ophthalmology*, XX: 1, p. 5. December, 1937.
6. Parsons, John H.: "Diseases of the Eye," p. 658. New York: the Macmillan Company, 1936.
7. Nowakowski, B. A.: "The Measurement of Glare." *American Jour. of Hygiene*, VI: 1–31. January, 1936.
8. Lebensohn, J. E.: "Factors in Determination and Interpretation of Acuity." *Archives of Ophthalmology*, X: 103–109. July, 1933.

Injuries to the Eyes*

Joseph Dessoff, M.D.

THOUGH wonderfully protected by the natural anatomical construction of the human skull, the eyes have become subject to a variety of injuries brought about especially by industrial hazards, and therefore require special consideration on the part of industry as well as medicine.

Anatomical and Physiological Considerations

Appreciation of the danger of injuries to our eyes must have exerted a developmental influence in nature's protective location of the eyeballs. The structures surrounding the orbit—the cancellous bone, the somewhat elastic layers, the sinus cavities lined with mucous membrane—form a peculiarly effective protective wall for the orbital cavity, while the abundant blood supply reduces the danger of traumatic infection. The bony orbit, projecting above, farther than the eyeball, and supplemented by the bridge of the nose, protects the eye from gross mechanical injuries. No less do the eyelids and other soft tissues about the eyeball give it protection. The thickness and massive structure of the eyelids supplement the protection of the orbit in persons having prominent eyeballs, such as those of the Negro race. Projecting points and flying particles, caught in the soft, movable tissues, are checked and diverted by such movement and are thus rendered comparatively harmless.

The general sensitiveness of the cornea and conjunctiva gives instant notice of foreign bodies; and the prompt and compelling reflexes, closing the eyelids and holding the parts fixed and the eye at rest, protect from other possible injuries. The strong reflex

* Read before the Institute on Conservation of Vision, sponsored by the District of Columbia Society for the Prevention of Blindness, Washington, D. C., November 18, 1938. The author expresses indebtedness to *The Eye and Its Diseases*, by Conrad Berens, for much factual material contained in this article.

cramping of the eyelid tends to keep in one position a foreign body caught under the eyelid. Even a sharp fragment, so caught, would cause less general scratching or scraping of the cornea than often results from inexpert efforts to remove a foreign body.

The structure of the normal eyelid is entirely suited to its protective function. Its smooth lining is furnished by healthy conjunctiva and it fits closely over the eyeball. The eyelid is freely movable and can push aside under the impinging force of a foreign body and direct that force to act more obliquely on the eyeball, or away from it entirely. The oily secretion on the margins of the eyelids retains the tears in the conjunctival sac, keeping the cornea always moist, and preventing mixture with fluids that might be injurious. The lashes, curving from the eyelid margins, come together when the eyelids are nearly closed, so that, while permitting some vision, they form an almost complete screen for the exclusion of small insects and flying particles of dust, threads, or hair.

The lacrimal secretion, or tears—a mild, soothing, neutral solution bathing the cornea and conjunctival sac—has a chemical composition that makes it an effective germicide to combat infections that may be carried to the eye by the atmosphere. The secretion of tears is instantly increased by any irritating contact with the cornea or conjunctiva. Thickening of the tears by increase of mucus entangles dust and carries it away. The involuntary rolling up of the eyeball, with spasmodic closing of the eye when an irritant gets into it, places the cornea in a position affording the greatest protection from suddenly increased secretion. An understanding of the importance of the eyelids and lashes as protection to the eyes should prevent neglect of certain lid conditions often tolerated in childhood.

Types of Injuries

Injuries of the eyes may occur to persons of all ages. In a neighboring state a statistical study of ocular injuries occurring after the passage of the Workmen's Compensation Act of January, 1916, reveals that in 15 years 8,619 eyes were lost, for which compensation amounting to $12,541,673 was paid. The number of eyes lost was greater than the number of lost legs, arms, hands, and feet combined.

Foreign bodies in the cornea constitute the largest single class

of injuries. They are usually superficial, but at times are found deep. Many varieties of substances may be found imbedded in the cornea: bits of glass, stone, oyster shell, scales of paint or metal, mostly iron or steel. In all cases the foreign body should be removed promptly to prevent inflammation, sloughing and ulceration of the surrounding layer of tissue, nature's method of accomplishing the removal of a foreign body that is left undisturbed.

Following the extraction of a hot, metallic foreign body, it is essential to remove the layer of brownish, burned or oxidized tissue usually remaining. If a corneal bur is used to remove this tissue, it will in addition smooth out the surface and the rough sharp edges of the foreign body crater, eliminating a harbor for bacteria and adding greatly to the patient's comfort.

The infrequency of injuries to the conjunctiva alone is due to its loose attachment to the sclera. This permits the conjunctiva to give before an impact by sliding and stretching. The conjunctiva frequently retains a foreign body. Lacerations and tears soon heal by primary union; when extensive, they can be repaired by suturing with fine black silk. Mild injuries caused by dust, vapors, fumes, and trauma may produce traumatic conjunctivitis, a painful irritation associated with intense redness, sensitivity to light, tearing and swelling of the eyelids. In addition to the large number of foreign bodies the cornea may harbor, it is subject to painful abrasions and erosions. If neglected and allowed to become infected, these lead to ulcer formation. Non-penetrating incised wounds usually heal promptly when no infection is present.

Burns and corrosive injuries are caused by hot water, steam, hot metal, gunpowder, corrosive gases, cigar ashes, acids and alkalis. Probably the most frequent of all alkali burns is caused by lime and probably the most severe is caused by ammonia. As a rule, the injury is more severe in the lower part of the conjunctival sac, and frequently is much more severe than the initial examination indicates. Often the conjunctiva, at the affected area, is destroyed and converted into an ulcer followed by the formation of a scar. Adhesions may form between the eyelids and eyeball, or between the eyelids and skin of the face. The prognosis as regards sight depends primarily upon the condition of the cornea. Any corrosive substance should be removed immediately and acids neutralized with

sodium bicarbonate. Alkalis can be neutralized by acetic acid or boric acid and, in the absence of these, copious irrigations with water are usually advisable.

Injuries with blunt objects may be very serious. The eye may be compared to a rubber ball. Any force, such as a blow by a fist, sufficient to produce compression of the eyeball, may lead to a variety of changes. The lens may become dislocated; the iris may be ruptured or torn away from its attachment; the choroid may rupture near the macula; frequently a detachment of the retina occurs and intra-ocular hemorrhages are common. Greater force leads to rupture of the eyeball.

The eye may be variously affected by light rays. The eye is well able to tolerate visible light. The protection by reaction of the pupil is valuable on account of its promptness. Dark glasses can never be so effective in protecting the eyes against light, and only the darkest are of much help. Transient effects of strong lights are scotomas or blind spots, but whether permanent damage can be produced by visible light is doubtful.

The eye is also sensitive to the invisible light rays. Infrared rays may produce cataracts, as in glass blowers: while eclipse blindness with actual changes in the retina at the macula is probably due to the heat action of the same rays. Snow blindness and electric ophthalmia are caused by ultraviolet rays; no permanent change is produced but the immediate reaction may be very severe. *X*-ray and radium emanations have frequently produced cataracts when the eye was carelessly protected during treatment.

Perforating injuries of the eyeball are fraught with danger. A careful study of the history will usually, although not always, indicate the character of the missile. A case in mind is one that was seen at the Episcopal Hospital recently. The history was that the patient was struck in the eye with a whip, but an *x*-ray taken two months later revealed a piece of wire one inch long in the eyeball.

The patient's statement after the accident that he saw the foreign body is not to be relied upon. In all cases an *x*-ray should be insisted upon.

The diagnosis of a perforating wound is established by several factors:

1. The presence of a visible laceration of the cornea or sclera,

which gapes on pressure. However, the absence of a visible wound does not mean that a foreign body is not present. In some instances small, very thin, metallic foreign bodies have penetrated the eyeball with no discoverable wound of entrance.

2. Reduction of the intra-ocular pressure or softening of the eyeball is a helpful sign.

3. Prolapse of pigmented tissue.

4. Prolapse of the vitreous: This generally takes the form of a bead, or stringy viscid mass, like the white of an egg, which prevents healing and favors infection if allowed to remain.

5. A shallow anterior chamber.

Penetrating wounds are generally produced by sharp objects or missiles that do not enter the eyeball in their entirety, as when a nail springs out from under the glancing blow of a hammer and its point lodges in the eyeball, the remainder being outside. In these cases the severity of the injury is related to its location, the extent of the damage to the structures involved and the very great danger of infection. Cases have been reported in which clean wounds healed without operative intervention, in certain cases without medical aid. However, complications are more apt to follow owing to the inclusion of various tissues in the scar.

Every eye with an intra-ocular foreign body is potentially lost. An *x*-ray should be made in every case of perforating wound of the eye and accurate localization secured by utilizing the modern methods. Magnetic foreign bodies can be detected by approaching a hand magnet or giant magnet to the eye. When this is close enough to bring the foreign body within the magnetic field, the pull on the metal causes pain and slight bulging of the tissues directly over the foreign body. The magnet must be carefully handled in order to avoid the danger of imbedding the foreign body in the tissues, making the extraction more difficult to perform as well as producing additional damage. If the magnet is suddenly brought close to the eye, it may exert too strong a pull on the foreign body, which may be drawn through and injure the lens.

There are reported in medical literature many cases of foreign bodies that have remained in the eyeball for varying periods of years.

Occasionally foreign bodies in the vitreous may be spontaneously

extruded after having destroyed the sight. Instances of pieces of glass and iron working out in this way have been reported by various writers.

Most eyes containing foreign bodies react promptly with severe inflammation. A quiescent case is never certain to remain so, and may suddenly flare up without warning and cause total destruction of the eye. So long as a piece of metal remains in the eye there is always the danger of severe inflammatory reaction. An almost constant chemical reaction takes place as the foreign body is slowly dissolved by the solutions of the eye. A small particle of glass may produce only slight reaction, but copper is rarely tolerated and generally produces a severe purulent inflammation with destruction of the eye.

Sympathetic Ophthalmitis

This is one of the most dreaded eye diseases with which the ophthalmic surgeon must contend. It is a special form of inflammation in which, as a result of injury or disease of one eye, inflammation is set up in the fellow eye. It is fortunately a rare condition. The majority of cases are due to perforating wounds, either traumatic or operative. Wounds through the ciliary body are most likely to be followed by sympathetic ophthalmitis, while corneal wounds without prolapse of the iris involve only slight danger of the disease.

Sympathetic ophthalmia has occurred after operations on the eye, particularly after cataract operations; it may also occur after perforation of a corneal ulcer, and following the development of intra-ocular tumors.

Every clinician has seen numbers of severe wounds involving the ciliary body which have healed without the development of sympathetic ophthalmitis, and there is no way in which it may be told from the onset whether sympathetic ophthalmitis will develop. It is generally recognized that the clean wounds which heal without signs of inflammation are free from danger, and that when a purulent infection has developed the danger is also slight.

The cause of sympathetic ophthalmitis is unknown. Many theories have been proposed but none are definitely proved. Probably an infection with some living organisms occurs in the injured eye, and the infection is then transmitted to the other eye.

In the majority of cases the second eye becomes affected between 4 to 8 weeks following the injury. Some cases have been reported as occurring years after the injury, although these are rare and somewhat doubtful. The first sign usually noticed in the second eye is a gradual loss of vision. Somewhat later sensitivity to light occurs and there may be slight pain. The eye may become hard at first, but as the condition progresses it becomes very soft.

Some cases seen very early may respond to treatment as readily as the average case of iritis. Cases seen later, and a number of those which are seen quite early, run a severe course in spite of treatment and go on to shrinking of the eyeball. The typical case responds to treatment very slowly and remains active for months.

The diagnosis of a typical case is seldom difficult. When a history of a penetrating wound is given, one naturally thinks of sympathetic ophthalmitis at the first sign of inflammation in the second eye. If this occurs within six weeks after the injury and the injured eye is still inflamed, the diagnosis is almost certain. If inflammation occurs after much longer periods, other causes must be considered and searched for.

The most important consideration in the treatment of sympathetic ophthalmitis is the prevention of the disease. Prompt enucleation of eyes following severe injuries undoubtedly prevents many cases and should always be urged when no vision is present and the injury is one which will render the cosmetic effect worse than that of a glass eye. When the injured eye retains vision, the decision as to proper procedure becomes a difficult one indeed. In the case of patients who cannot be properly observed and controlled, one is inclined to err on the side of safety and remove eyes which might be saved under more favorable circumstances.

When sympathetic ophthalmitis is already present, the injured eye, if already blind, should be removed. But if vision is present in the injured eye, it is often best to leave it in because ultimately this eye may be a more useful one than the secondarily affected one.

When enucleation is decided upon it should be performed at once —a delay of one or more days may materially affect the outcome.

A doubtful prognosis must be given in sympathetic ophthalmitis, since some cases, especially those in children, seem almost unresponsive to treatment.

Treatment of Injuries of the Eyes

Superficial injuries of the cornea and conjunctiva should be flushed thoroughly with warm boric acid or salt solution. Any foreign matter difficult to wash out may be removed with a wet cotton applicator or picked out with forceps. Abrasions and erosions in the surface epithelium of the cornea can be detected by the use of a corneal stain, fluorescein, which colors them a brilliant yellow green. The instillation of a few drops of a local anaesthetic solution, or the application of an ointment containing a local anaesthetic, quickly relieves pain and light sensitivity. In some cases smoked glasses will give relief, but greater comfort and protection may be obtained by the application of a sterile dressing or a bandage.

Iced compresses are of value when applied early. They should be used continuously in the acute stages of severe cases. Some ophthalmologists prefer heat in the form of hot applications or compresses. The instillation of homatropine or atropine will prevent inflammation of the deeper structures. When severe wounds are contaminated by dirt or have been exposed to infection through delay in receiving proper treatment, the patient should be given tetanus antitoxin. In gunshot and penetrating wounds also tetanus antitoxin should be given immediately after the injury.

If injuries are complicated by infection into the anterior chamber of the eye, injections of a non-specific foreign protein are of value. Boiled milk, typhoid vaccine and diphtheria antitoxin are favorites in use. The treatment is successfully used to build up general resistance to infection.

Lacerations of the conjunctiva should be sutured with fine black silk unless the edges are in apposition, in which event the wound will heal without suturing.

Wounds of the corneoscleral junction are often complicated by prolapse of the iris, ciliary body and choroid. If the iris has prolapsed, that portion should be grasped with forceps, withdrawn, and carefully excised to remove the portion damaged by compression between the edges of the wound. If the ciliary body or choroid has prolapsed, it should be carefully replaced. These wounds may be covered with sliding conjunctival flaps. Wounds in the center of the cornea may require complete covering with conjunctiva either as a sliding flap or by a purse-string suture.

When wounds are so extensive and destructive that it would be impossible to preserve the eye or avoid the danger of sympathetic ophthalmia, immediate primary enucleation is done. Following the primary repair of a penetrating or perforating wound or injury a successful termination should be expected if the inflammation gradually subsides, if pain, irritation and photophobia disappear, and if function is restored either partially or completely. On the contrary, unfavorable symptoms may develop, as when the vision is entirely lost and the eyeball is painful and dangerous to the fellow-eye. This condition necessitates late or secondary enucleation.

The first step in the treatment of a foreign body in the vitreous should be the immediate removal of the foreign body. If magnetic, the hand magnet or giant magnet may be used. Non-magnetic lead shot may be removed by use of a specially constructed forceps and the aid of a biplane fluoroscope. A foreign body in the lens produces less reaction than in any other part of the eye, and may be extracted with the cataractous lens.

Foreign bodies in the anterior chamber of the eye may be removed after opening the anterior chamber, by flushing or by the use of forceps. When embedded in the iris, they can be removed by excising the section of iris containing the embedded foreign body.

Compensation for Injuries

Injuries may result in permanent or partial loss of function or permanent loss of one or both eyes. Almost all states have workmen's compensation laws which regulate the amount of money to be paid for injuries resulting in permanent or partial loss of one or both eyes. Before the compensation due a workman can be fixed, it is necessary to determine the amount of damage to his eyes and their function caused by the injury. In order to determine the degree of visual efficiency, three elements of vision must be studied: first, the acuteness of vision; second, the field of vision; and third, muscle function. Although these factors do not possess an equal degree of importance, no act of vision is perfect without the coordinated action of all.

The maximum limits of visual efficiency consist of a visual acuity of 20/20; a full visual field; and the absence of double vision. The minimum limits of visual efficiency are a visual acuity less than

20/200; a visual field contracted to 5°; and the presence of double vision in all directions.

To calculate the dollars and cents value of an eye is a complicated problem, since no two persons have the same earning ability nor can an impairment of earning ability be calculated by mathematics alone. Compensation for ocular injuries is based on the percentage loss of visual function as it affects the earning ability of the individual.

Prevention of Injuries

No discussion on injuries of any kind is complete without reference to protective and preventive measures, and eye injuries are no exception to the rule. One thing that is often overlooked in discussions of this kind is the importance of wearing correcting glasses when they are indicated.

So commonly are correcting lenses required that they may be regarded as a supplemental defense against ocular injury. Injuries become less frequent when lenses are constantly worn. In certain occupations in which injury from small, flying foreign bodies is common, the enforced wearing of protective goggles has diminished to a marked degree the number and danger of such injuries. Accurate vision, secured by glasses, has another protective influence that is not so generally understood. Exactness of orientation and co-ordination depends on accurate vision, which is often impossible without correcting lenses. Instant response to impending danger cannot be developed in one who has myopia or astigmatism, except for the limited range of accidents which can be apprehended with diminished visual acuity. Lack of protective reflexes dependent on sight is an important cause of accidents to children and elderly people.

The development of co-ordinations and reflexes to avoid such dangers is a condition necessary to bodily safety. The maintenance of the best vision must be considered essential to health, and the wearing of needed glasses a physiologic condition that may rank with a normal supply of oxygen, food or water. Co-ordinations and reflexes are developed at first by observations and responses that are conscious and voluntary; then they become habitual and unconscious and finally are established as reflexes. This development

cannot be complete unless the impressions that originate protective reflexes are constantly repeated. Every person who puts on glasses has to pass through the adaptive process. It begins with the wearing of glasses, it is interrupted by leaving them off, and must be repeated whenever they are worn. The person who does not like glasses may wear them interruptedly for months or years without establishing the co-ordinations of vision and motor reflexes essential to safety. For young people handicapped by defective refraction, the constant wearing of corrective glasses is most important as a part of their protection against accident.

Some measures adopted in large industrial centers for the protection of the eyes of employees might be applied to the protection of the public in general. These include the following:

1. The preliminary and necessary periodic examination and refraction of the eyes.
2. The special examination and fitting with glasses for exacting work requiring accurate vision.
3. The selection of goggles and masks with the proper optic lenses.
4. The prevention of electric ophthalmia.
5. The use of various types of glass to eliminate ultraviolet and infrared rays when these are injurious to the eyes.
6. The guarding of machines to prevent flying particles and sparks striking the eye.
7. Proper illumination and elimination of glare with consequent reduction of eye fatigue.
8. The elimination or neutralization of fumes and gases causing inflammation and irritation.
9. The training of personnel in the first-aid dispensary.
10. The stimulation of interest, activity and co-operation in safety committees.
11. Legislation to control the sale of fireworks, explosives, and toys which are apt to be dangerous to the eyes of children.

An Evaluation of Vision-Testing Methods in Schools*

John B. Hitz, M.D.

THE author presents this useful evaluation of the various methods of testing vision in the schools—of special interest to school physicians, school nurses, and teachers.

THIS study was undertaken because of a considerable number of inquiries on the part of educators and physicians in regard to the proper or best methods of testing school children's vision, and because of rather definite disagreements among ophthalmic physicians as to how detailed a vision test should be used in the schools.

It is assumed at the outset that a "screening" test for visual efficiency in schools should have certain attributes. It should pick up the majority of visual deficiencies without including minor transitory visual disturbances, functional or psychological in origin; it should be quick and easy to operate without the need for special training or technical knowledge.

This paper is in the nature of a preliminary report, comparing a small series of subjects tested with the Snellen chart, the stereoscopic method of Betts, and by a thorough ophthalmological examination. The group comprised 32 ch.'dren, ranging in age from 6 to 14 years, all of whom were referred to the ophthalmological department of the Milwaukee Children's Hospital; hence they do not represent a cross section of average school children.

All children in this series had received a retinoscopic refraction under either atropine or homatropine cycloplegia by the cylindrical method of Lindner. The refractions were all tested by the author

* This is a preliminary report, reprinted, with permission, from the September, 1938, *American Journal of Ophthalmology.*

within six months preceding the time of examination. The cases were unselected except that those of obvious ocular disease and manifest strabismus were eliminated.

The standard Snellen chart at six meters was used with uniform artificial illumination. The intensity of the light was not measured. The Betts tests were administered as recommended in Betts's textbook on remedial reading. This test was immediately followed by what we shall term an ophthalmic test, consisting of a Snellen test for distance as above, and a muscle-balance test at six meters and at 33 cm., using the Duane screen prism test and the Maddox rod. As far as possible the average of the two was recorded. Fusion tests employed were the Worth four-dot test at six meters and 33 cm., at six meters the dots subtending an angle of 12 minutes and the distance between dots subtending an angle of 21 minutes; the four-dot at 33 cm., subtending an angle of 51 minutes, the distance between dots an angle of 177 minutes.

Depth perception was tested on the Howard-Dolman apparatus, the operator setting the instrument according to mathematical chance (twenty cards shuffled before each test), correct answers in 8 out of 10 tests at a given separation of the pegs being considered as the correct determination. No subjective tests for astigmatism were attempted.

Results

A total of 48 tests was made on 32 patients, tests being made both with and without glasses.

A comparison of the Snellen test alone (with 20/30 vision or better being taken as normal) with the Betts test and thorough ophthalmic test revealed that in 48 examinations with the Snellen test visual defects were revealed in 24 (50 per cent). With the Betts test defects were found in 43 (89 per cent). By the ophthalmic test defects were present in 33 (69 per cent).

Analyzing the individual tests of the stereometric and the ophthalmic groups, we find in the comparison of visual acuity a total of 96 tests (two eyes, 48 examinations). In 74 tests (77 per cent) the two tests agreed (that is, the figures agreed within 20 per cent, using the industrial percentage of visual-loss tables published in Berens's textbook on ophthalmology). In 22 cases (23 per cent of

total) there was a disagreement, and of this group in 15 tests (66 per cent), the Betts test disclosed the greater deviation from normal; in seven tests (33 per cent) the ophthalmic uncovered a greater error.

This discrepancy in figures is explainable on two counts: first, using the dot test, higher astigmatic errors are not picked up; second, the stereoscopic test allows suppression to occur which is not possible in the ophthalmic tests.

In the muscle-balance tests (that is, the average of the screen prism tests and Maddox rod) an esophoria or exophoria at 6 meters of 4 diopters was considered abnormal; an esophoria of 4 diopters or an exophoria of 6 diopters was considered abnormal at 33 cm.

Out of 96 tests (48 examinations for both 6 meters and 33 cm.), in 81 (84 per cent) the Betts and ophthalmic tests agreed. In 15 tests (16 per cent) there was disagreement, and of these the Betts tests disclosed a greater deviation from normal in 3 (19 per cent), the ophthalmic in 12 (81 per cent).

The discrepancies here can be accounted for, first, because the standards set in both tests were purely arbitrary, and, second, because there is admittedly a psychic convergence stimulus in the use of the stereoscope as a test for muscle balance.

The visual angles subtended by the fusion tests (Worth four-dot at 6 meters and 33 cm.) in the ophthalmic group were given previously, 12 minutes at 6 meters, 51 minutes at 33 cm.; the angle subtended by the Betts tests is 17 minutes, both distance and near being the same, the only difference being the amount of accommodation and convergence employed. In 96 fusion tests (48 examinations for distance and near) the Betts and ophthalmic agreed in 49 (51 per cent), disagreed in 47 (49 per cent). Among those which disagreed the Betts tests showed a greater deviation from normal in 40 tests (85 per cent), the ophthalmic in 7 tests (15 per cent). At least one cause of the discrepancy in these figures is obvious; namely, the difference in the visual angles subtended by the various tests. And again the psychic convergence of the stereoscope probably is a factor.

The comparison of depth perception or stereopsis is a somewhat difficult problem inasmuch as accommodation and convergence play a much larger rôle in the measurement on the stereoscope than

in the Howard-Dolman apparatus. Mathematically the comparison can be made by measurement of the parallactic angle. With the Howard-Dolman apparatus a depth perception of 25 mm. at 6 meters subtends a parallactic angle of 10.4 seconds; depth perception of 150 mm. subtends an angle of 56 seconds. Comparatively the Betts stereopsis slides subtend angles varying from 140 seconds to 1,300 seconds. With this large difference in the mathematical comparisons, even allowing a large percentage of error for the factors of psychic accommodation and convergence, one can safely assume that anyone showing a depth perception of 50 mm. or under on the Howard-Dolman apparatus should show close to 100 per cent stereopsis on the Betts test and, conversely, any subject showing near 100 per cent with the Betts test might logically show no depth on the Howard-Dolman. Taking this basis for comparison we find agreement of the tests in 34 (72 per cent) of 47 tests. In 13 tests (28 per cent) the Betts tests showed 70 per cent stereopsis or better, while the Howard-Dolman, a much more accurate test mathematically, showed a depth-difference perception of better than 50 mm. at 6 meters. In commenting on the discrepancy in these two tests one can only say that depth perception under natural conditions, as with the Howard-Dolman apparatus, assuming, of course, a nearly normal visual apparatus, is an easy automatic psychic act, while many persons have difficulty and must make a conscious effort to obtain stereopsis on an instrument such as the stereoscope.

In attempting to compare the Betts sharpness-of-image tests with a test used in average ophthalmic practice the only tests available are the astigmatic dials. These tests seemed to us to be impractical of application in a series of young children. The Betts tests were therefore compared to an arbitrarily selected standard of refractive error found on retinoscopy under cycloplegia. The limits of normal refraction were taken as minus 25 D., plus 1.00 D., and one-half diopter astigmatic error.

On this basis the Betts and refractive tests agreed in 25 (78 per cent) of the 32 subjects with uncorrected vision and disagreed in 7 (22 per cent). Of these seven tests, Betts showed the greater deflection from normal in four, the refraction in three. In the 16 corrected with glasses there was agreement of the tests in 9 (56 per

cent) and disagreement in 7 (44 per cent). In other words, in the cases of uncorrected vision there was a 22 per cent discrepancy in findings comparing the Betts astigmatic test with an arbitrary amount of refractive error. However, when that error was fully corrected to the best of the author's ability with accepted methods of refraction there remained 44 per cent of the subjects with corrected vision who still showed errors with the Betts test.

Discussion

In discussing methods of testing school children's eyes one can easily get into a controversy on how high a standard should be set; this then quickly leads to a discussion of whether the average children's eyes are deficient, or whether the educational requirements today are too great for the physical (ocular) equipment with which nature has endowed us.

Therefore, let us set forth a few postulates which would seem to be fair criteria of a screening test to be used in the schools for the selection of those who should be referred to an ophthalmologist for examination because of defective vision:

1. As stated earlier, any such test should pick up most errors without finding minor transient psychic effects.
2. The test should be easy to operate.
3. The test should not be more discriminating than the accepted thorough examinations utilized by the majority of competent, well-trained ophthalmic physicians.
4. If the principles on which the test is based are different from those accepted by competent ophthalmologists, then at least the findings must agree fairly accurately with the findings of a thorough ophthalmic test.

The Snellen chart alone, having missed a considerable number of errors recorded by both the Betts and the ophthalmic tests, would be eliminated by the first postulate.

Ease of operation would eliminate any such complete test as described as the ophthalmic test in this paper.

The Betts tests immediately open themselves to criticism as being too discriminating, since they picked up errors in 89 per cent of cases as against 69 per cent in the ophthalmic test. Further, in analyzing the individual tests of the Betts series, one finds that in

the visual acuity tests, the fusion tests, the depth-perception tests, and the sharpness-of-image tests, the Betts series was definitely more discriminating, and that in the muscle-balance tests alone the ophthalmic test disclosed a greater deviation from normal. In fairness to the manufacturers it must be stated that they ask that the test be accepted as a whole, not separated into its component parts. This request does not appear to me to be reasonable, since the whole test is made up of its component parts and errors creeping into the individual test must influence the accuracy of the test as a whole.

Finally, the question arises as to whether the findings of the Betts test agree (inasmuch as the principle of the stereoscope is brought into the picture) essentially with more or less standard accepted ophthalmic tests. In the visual acuity tests there is a discrepancy of 23 per cent, in the muscle-balance tests a difference of 16 per cent, in the fusion tests a difference of 49 per cent, in the depth-perception tests 28 per cent, and in the sharpness-of-image tests compared to refractive errors, 22 per cent.

Conclusions

1. This paper is to be regarded as a preliminary report, and definite conclusions from such a small series of cases admittedly not average school children must be drawn with great caution. It would appear that on the basis of this study the Snellen chart alone is inadequate as a test for school children's visual efficiency.

2. That the Betts tests in their present state of development pick up errors that are transitory or do not exist in the normal use of the eyes.

3. That the thorough ophthalmic test is impractical and that the ideal may be to add to the Snellen test a simple test of fusion and muscle balance which could be operated by the teacher or school nurse.

Annual Conference of the National Society for the Prevention of Blindness

NEW YORK will be the Mecca of the New World during the forthcoming months devoted to the activities of the New York World's Fair, 1939. With the hope that the headquarters of the National Society for the Prevention of Blindness will be the Mecca for the prevention of blindness workers in the United States during this time, the Society is planning to hold its Annual Conference October 26, 27, and 28, so that those from distant points who may be planning to enjoy the World's Fair may perhaps make their plans so that they may at the same time participate in the program of the Society.

Headquarters for the Annual Conference will be the Astor Hotel in New York City. The Society will be glad to make reservations in advance at this or other adjacent hotels for anybody planning to participate.

It is hoped that the Conference will bring together from many states physicians, teachers, nurses, social workers and those active in the various fields of sight conservation. Arrangements will be made for extending the facilities of the Society's offices at Rockefeller Center, 50 West 50th Street, to all visitors.

Following is a tentative program indicating topics and time planned for the various meetings:

Thursday, October 26

Morning —Nursing as It Relates to Sight Conservation.

Luncheon Meeting—Possible continuance of the above topic.

Afternoon, 4:00 to 4:30—Annual Meeting of the National Society for the Prevention of Blindness.

Dinner Meeting —Subscription dinner sponsored by the Board of Directors.

Friday, October 27

Morning —Sight Conservation in Industry.

Luncheon Meeting—The Doctor in Conserving the Sight of the Preschool Child.

Afternoon —Social Work in Prevention of Blindness.

Dinner Meeting —Subscription dinner on medical participation in the prevention of blindness.

Saturday, October 28

Morning —Sight-saving classes.

Luncheon Meeting—Summaries of topics presented during the sessions of this conference.

A complete program containing the speakers and exact subjects of individual papers will be printed when plans for the Conference are completed, and will be sent to anyone applying to the Society's offices for copies.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request

A Proposed Sight-Saving Class Program for Tennessee*

Editor's Note.—This is an extract comprising an abstract of, and a chapter from, the author's master's thesis, "A Proposed Sight-Saving Class Program for Tennessee."

Abstract of Thesis

The problem involved in this study is to determine what sight-saving classes are, the extent to which these classes are being used by the different state systems, and whether or not they should be included as an integral part of the educational program of Tennessee.

The data upon which this study is based were obtained from eight sources: first, current professional literature; second, reports of the White House Conference on Child Health and Protection; third, the National Society for the Prevention of Blindness; fourth, the library of the American Foundation for the Blind; fifth, a visit to the sight-saving class in the Maury School, Memphis; sixth, records of the Tennessee School for the Blind; seventh, state publications of the Department of Education; eighth, United States Office of Education bulletins.

The findings of this study may be stated as follows: first, sight-saving classes are no longer experimental and compose an integral part of other state programs; second, they have three fairly definite aims: (1) to instruct pupils with a minimum of eyestrain; (2) to teach children to conserve their own vision; (3) provide vocational training for children of low vision; third, these classes have proved to be the best form of special education for children of low vision; fourth, the principles of sight saving are out-

* From the author's master's thesis, "A Proposed Sight-Saving Class Program for Tennessee," George Peabody College for Teachers, Nashville, August, 1938.

lined primarily for the conservation of vision while the child is being educated in the regular classes with children of normal vision, thus giving a valuable social training; fifth, sight-saving classes are essential to a state school system in order to satisfy the social and economic aims of education; sixth, these classes are economical: (1) they increase the rates of promotion; (2) sight-saving pupils are often returned to the regular classes with improved vision; (3) they make social assets rather than juvenile delinquents out of partially-sighted children; (4) it is far cheaper to educate children of low vision in these classes than in residential schools for the blind; seventh, Tennessee should establish sight-saving classes in the following cities: Chattanooga, Jackson, Johnson City, Knoxville, Memphis, and Nashville. A class at the Tennessee School for the Blind will serve partially-sighted children from rural sections not reasonably close to one of these cities.

Sight-Saving Class Pupils in Tennessee

The 1937 annual report of the department of education of Tennessee shows that it has an elementary school population of 436,569 white children. According to the accepted ratio recognized by Newton* and Hilleboe†, one sight-saving class pupil in each 500 of school population, there are approximately 873 boys and girls in this state who need the advantages of this specialized form of education. At present there are 16 of this number who are being properly cared for in the Memphis class, and there are 33 others who are pursuing the course of the totally blind, which means that there may be 824 pupils who are afflicted with low vision either from some defect of the eye or some disease that impairs vision, who are being neglected by the state educational program.

For nine years the Junior League of Memphis tried to establish a sight-saving class in Memphis; and finally, with the aid of the city health and education departments, together with the Sight-Saving Council, a class was organized in the fall of 1937 at the Maury School under the instruction and supervision of Miss Rosalie Dunagan, who had received instruction and training in sight-saving class work at the Western Reserve University, Cleveland, Ohio. The class was composed of 14 pupils at the beginning, but the number grew to 16. It is interesting to note that these children, representing only five grades because there were none in the third, came from 12 schools which were located in every section of the city.

The expenditure for special lighting fixtures and sight-saving furnishings ran close to $4,000; however, the authorities realize their

* Newton, Florence Louise, *Sight-Saving Classes in the United States: Their Development and Interpretation*, 1934, p. 19.

† Hilleboe, Guy L., *Finding and Teaching Atypical Children*, 1930, p. 83.

mistake in spending so much money. The room, which is 23½ by 33 by 13 feet, is lighted by six totally indirect lamps of 1,000 watts each. These are equipped with switches of several speeds so as to govern the intensity of light to suit the day, bright or cloudy. The room has 248 square feet of blackboard surface, which may be lighted by other special lights. The orientation is northern, but the building is rather old, and the windows do not give the proper ratio for natural light. The ceiling is white, the walls are buff with gray trimmings, and the shades, adjustable from both top and bottom, are buff also. The desks are adjustable from the horizontal to the vertical, and they are not anchored to the floor, making it easy for individual pupils to adjust themselves to the light. Lesson plans are prepared on a typewriter with large type, and these materials may be mimeographed for the students for lessons that are not available in the large-type books.

The class is operated on the cooperative plan, whereby the children go to the regular classes to recite their lessons. The members of the Junior League take turns in assisting the teacher with the preparation of lesson plans and in doing individual work with the pupils. These young women are to be commended for the splendid work they have done in showing the educators of Tennessee that sight-saving class work can be done in Tennessee just as well as it can in other states.

The League is so well pleased with the accomplishments that plans are being made for the organization of a junior high school class in the near future.

According to a survey of the blind and partially sighted which was conducted in Tennessee by the Department of Education in 1935–36, Nashville was the only city in which enough children were found to start a sight-saving class. Most of these 13 have attended the residential school for the blind since that time. This is no indication that the other cities do not have children of low vision, but it does indicate that they were more easily found in Nashville. The fact that the residential school and the Commission for the Adult Blind are both located in Nashville, no doubt, is a partial explanation of this occurrence. In the other cities, the men taking the survey did not have as good means of contact.

The survey was conducted by three men, one in each grand division of the state, who went from place to place getting, as best they could, information concerning the residence of these children. In some sections, especially the rural, it was very difficult to find the blind and more difficult to find people of low vision.

A check-up on the sighted pupils in the residential school for the blind is a good way to get a start

in locating sight-saving class pupils. A similar check-up was made at the Illinois School in 1931, at which time the work was instituted in the school.

In order that we may better understand the term "normal visual acuity," it is well to see just how the measurement is made. The White House Conference report states:

In the so-called normal eye the visual acuity is indicated by 20/20, meaning that at a distance of 20 feet from a properly lighted and properly hung chart the person being tested will be able to read the letters, figures or signs indicated as the 20-foot line. A person having a visual acuity of 20/40 would, at a distance of 20 feet from the chart similarly arranged, be unable to read the line he would see at that distance, but can read a line that he should be able to see were his vision normal at a distance of 40 feet. It must be stressed, however, that this would not indicate a loss of 50 per cent of vision. According to the ophthalmological table, he would have remaining a visual acuity of 83.6 per cent. Near vision is measured in the same way, the notation being stated in inches.*

It may be noted here, too, that from 20/20 to 20/60, inclusive, is considered normal vision; from 20/70 to 20/200 is considered partial vision, or sight-saving class range of vision; and, below 20/200, vision is not sufficient to allow children to carry on their school work with the regular public school classes; thus, members of the latter group are considered educationally blind and must resort to the sense of touch as a means of obtaining an education just as though they were totally blind.

A survey of the records of the sighted pupils in the Tennessee School for the Blind reveals the fact that there are eight pupils in the school whose vision is normal and 24 others who have vision sufficient to attend sight-saving classes. Of this number there are no pupils who live reasonably close to Memphis. Nine of the number live in Nashville, two in Chattanooga, and one in Knoxville. The study of the records also shows that there are other pupils who have recently had eye operations that will, no doubt, improve their vision to the extent that they will be able to read large print. There are still others who need to have operations performed, but their parents have not given consent.

The study also shows that the pupils are distributed throughout the eight grades, and there is a rather wide range of vision, varying from nearly perfect to the lower range of visual acuity requiring sight-saving class facilities. These pupils are required to read their lessons in Braille, and they are segregated with the totally blind. They are at home during the summer months, losing valuable home training during the regular school year.

* Section III, 1931, p. 128.

Since most sight-saving class work is done in the first six grades, we may say that there are 20 left in those grades. This is too many for one class, for the authorities say that 15 or 16 are sufficient. Taking it for granted that those of normal vision will be able to pursue work in the regular classes, and eliminating those from the cities, there will be enough left from the small rural communities to start a sight-saving class in the school—17 to be exact. Such a class will not be a function of the school, but other states have found that it is necessary to do sight-saving class work in order to care for low-visioned children from rural sections.

The age-grade table for these 32 pupils shows considerable over-ageness, which is characteristic of children of low vision who have not had the advantages of sight-saving classes. In the elimination of some of the failures—one of the strong points in favor of classes of this type—some of this over-ageness is overcome in a short while.

Illinois, Michigan, Minnesota and Virginia Schools for the Blind maintain sight-saving classes. These four states evidently have found it necessary to accept sight saving, not as a function, but, through the lack of a means of educating rural children of low vision, as a part of their work.

It is not expedient to try to maintain classes of two or three in small communities; and, rather than board pupils in communities doing sight-saving work, it is perhaps best to send them to the residential school for the blind, where thay can receive the proper discipline during their early years of school life.

Using the accepted ratio of one sight-saving class pupil to each 500 of school population, we find that there are six towns and cities with six pupils or more each. It is highly possible to have enough for a class in smaller industrial centers with the proper check-up on the eyes of the school children. We may readily see that the four cities should have enough for two classes each. Hilleboe* suggests that, in a city of 50,000 population or more, the ophthalmologists and physicians could refer to the school authorities enough cases to start a sight-saving class.

Teachers can very readily detect evidence of eyestrain as well as diseases of the eye. Hilleboe† also points out the fact that portable lighted boards can be constructed at a cost of only $1.50 each, at which price every school could very easily own one. In this way teachers can test the eyes of the children and refer to an eye specialist those whose visual acuity is low. This suggestion is made because of the fact that very few schools are able to employ specialists as regular staff officials.

* *Op. cit.*, p. 85.
† *Ibid.*, p. 83.

Conclusions

This study has been made, not with the idea of creating anything new, but with the idea of bringing before the state school officials the facts that exist concerning the phase of special education which at present is being most neglected of all of the phases of special education now being undertaken by the state system of public education.

Tennessee should formulate a sight-saving class program as an integral part of the state educational program, just as has been done with other handicapped groups, for the following reasons:

1. The training of children of low vision in sight-saving classes passed the experimental stage in other states many years ago, and this gives our state a chance to profit by the experience of some of the best school systems in the country. The slow process by which the work was added by the various systems is evidence of its significance. It is by no means a new fad.

2. There is no serious argument against sight-saving classes as a means of special education. No state has ever offered any other way of educating these visually handicapped children quite so efficient or economical, to take their place. Then there is only one alternative for Tennessee so far as this group is concerned.

3. The state is responsible to its citizens. Tennessee should provide a form of education for visually handicapped children that teaches them to overcome their handicap. Only one way of accomplishing this has ever been offered: through sight-saving classes.

4. Only about .4 per cent of the estimated number of children with low vision are being reached by the state educational program. This fact is alarming and is a matter of concern that demands immediate attention.

5. If the state cannot do something about this situation, the compulsory school law should be revised.

6. The proper sight-saving program beginning with preschool age will have a tendency to eliminate the necessity for this type of special education. This sort of program will teach children of normal vision how to conserve their vision, thus eliminating eyestrain.

Recommendations for Sight-Saving Class Program in Tennessee

In view of the preceding chapters, it is recommended that the following paragraphs serve as a basis or guide in formulating a bill to be presented at the next session of the General Assembly:

The management and control of all sight-saving classes, established in the various county, city and special school districts of Tennessee, shall be vested in a state director of special education.

The director of special education shall distribute or cause to be distributed books and other sight-

saving supplies to schools not able to maintain sight-saving classes to be used by children who have some temporary defect of the eye and who may be recommended to the director of special education by a recognized eye specialist. Such books may be sent from one school to another as the director of special education sees fit to direct.

The director of special education may arrange with any local board of education, which maintains a sight-saving class or classes designated to receive non-resident children, to pay for the board of any such children described under this act under such standards and with such restrictions as the director of special education may prescribe.

If a child of one district attends a sight-saving class in another district, the board of education of the district in which he resides may pay his tuition in a sum equal to the tuition in the district in which such class is located for a child of normal needs of the same school grade. Upon direction of the director of special education the board of education of the district in which such child resides shall pay for his transportation and tuition.

Any child not reasonably close to a district maintaining a sight-saving class may be assigned by the director of special education to a sight-saving class in the Tennessee School for the Blind. The board of education of the district in which he resides may pay his tuition in a sum equal to the tuition in Nashville for a child of normal needs of the same school grade.

The director of special education shall prescribe standard requirements for sight-saving classes, which requirements shall include the conditions under which such classes shall be conducted, the methods of instruction and supervision, the qualifications of teachers and the conditions and terms under which they are employed, the special equipment and agencies for instruction provided, and the conditions of the rooms and buildings in which the classes are held.

The director of special education shall allow any local board of education maintaining a sight-saving class or classes an amount up to $2,000 for equipment for each class maintained, such equipment to consist of lighting fixtures, desks, typewriters, clear type books, maps, globes, and any other equipment designated by the director of special education.

At the close of each school year, the board of education maintaining a sight-saving class or classes, or which has boarded sight-saving pupils or has transported any sight-saving pupils as provided in this act, may certify to the director of special education the names and residences of pupils instructed in such class or classes and the period of time each was instructed, and the names and residences of the pupils boarded or transported as provided under this act and the period of time each was boarded or transported; and the amount expended for special appliances and the current operating cost of the education of such pupils, together with statements showing the per capita cost of the education of normal children in the district in the same school grades during the same period of time.

The director of education, upon receipt and approval of the report

and financial statement provided in the preceding paragraph, shall present a voucher to the comptroller of the state in favor of the board of education in an amount equal to the cost of maintaining such class or classes, minus the cost of the instruction of the same number of children of normal needs in the same school grades of the district. He shall include in the voucher the cost of boarding pupils included in the provisions of this act at the rate of not to exceed $225 for each pupil so boarded for nine months during the school year or each fractional part may be calculated on the same basis. He may also at his discretion include the costs of transportation as provided in this act.

ELLIOTT STANLEY FORD

Contact Glasses*

Contact lenses are held in place on the eyeball by capillarity. When properly fitted, they actually form a part of the eyeball, and move together with the eyeball in all directions. In the event of a blow against the eyeball the contact lens will be displaced together with the eye in the direction of the blow, and even if the blow is very severe there is no more chance of the contact lens breaking than there is of the eye itself bursting.

Contact lenses therefore are actually a protection for wearers of spectacles who indulge in violent sports. For instance, a person whose glasses might be struck by a squash racquet would be in great danger of sustaining a perforating injury to the eyeball from a piece of glass, while for a person wearing contact lenses such a danger does not exist.

This theoretically formed opinion is confirmed by practical experience in that so far not a single injury has been reported from a broken contact lens, in spite of the fact that many thousands are today wearing contact lenses. As a matter of fact, experiments performed, for instance, by Erggelet show that foreign bodies, flying against a contact lens fitted to the eye, do not produce severe injuries. On the contrary, it is obvious that contact lenses provide better protection than spectacles against small foreign bodies (dust, rust, small particles of steel) which do not produce perforating injuries. While they may enter the superficial surface of the cornea, they will not be able to enter the solid contact lens.

In cases of keratoconus there might sometimes occur a harmless erosion of the cornea if the contact glass is worn too long, but this rare happening is certainly not a contraindication when one considers the tremendous optical help which patients with keratoconus derive from contact lenses. In addition, I should like to mention that there is a well-founded opinion that contact lenses may retard the development of keratoconus.

HERMANN M. BURIAN, M.D.
Dartmouth Medical School,
Hanover, N. H.

* Extract from a letter.

News of State Activities

THIS Section is devoted to the reporting of sight conservation activities carried on by official and voluntary agencies throughout the country. It presents information supplied by these groups, and serves as a medium for exchange of experiences. Brief and timely items only can be used, because of the limitations of space

A VERY warm response, including many practical offers of cooperation as well as endorsements of the idea, resulted from our request for news material for this department. Offers to provide information regularly have been received from fourteen state health departments, fourteen commissioners for the blind or departments of public welfare, five state medical societies, and five state organizations for prevention of blindness.

We hope before the end of the year to offer the same opportunity to other local organizations, such as departments of education, sight-saving class groups, local safety councils, and parent-teacher and other voluntary agencies who have adopted some aspect of sight conservation as part of their programs.

The following are items gleaned from material submitted:

Delaware

". . . The talking slide film, 'The Nurse's Responsibility in Preventing Blindness and Saving Sight,' has been used by us for staff education purposes. We have also made the film available to the schools of nursing in Delaware, and to the Visiting Nurse Association staff.

"We are planning to use the film in connection with teachers' meetings. We have not done so as yet, because we believe it will be necessary to prepare for its use through the distribution of some literature on sight saving.

"Dr. Woodbridge E. Morris, Director of Maternal and Child Health, is preparing a pamphlet for distribution. He discussed such a pamphlet with Miss Mumford when she was here in January . . ."

—*Delaware State Board of Health, Dover, Delaware*

Kansas

"The Kansas Association for the Prevention of Blindness, the Lions Club of Wichita and many of the public-spirited citizens of Wichita are pressing the matter of advanced legislation for the blind at the session of the Legislature at the present time. The Legislative Committee of the Kansas Association, of which Mrs. W. J. Logan is Chairman, has been in conference with the Committee on Social Welfare of the House of Representatives for some weeks and this Committee is now framing its measure. The following program* has been pressed:

"More money for social welfare out of the sales tax.

"Program for sight-saving classes in public schools.

"Continuance of the restoration of sight program.

"Adequate budget for the foregoing program.

"It is believed that the above program will be enacted into law without serious change.

"In the office of the State Director of Public Welfare, one day this week, the writer was told by the assistant director that the father of a boy now in the sight-saving class in the Wichita Public School came into the State Office and said that he wanted to make a plea for the continuance of that work. He said he had never seen such a change made in any child as his boy had undergone as a result of his year in that class. The dismal outlook on life that the boy had had prior to his entrance in that class had been changed into a joyous and happy and normal one. The world became altogether a new one. Life took on an entirely new meaning."

—*Kansas Society for the Prevention of Blindness, Wichita, Kansas*

Missouri

"The purpose of this note is to call attention to the great number of persons who appeal to the Missouri Commission for the Blind

* Only items relating to sight conservation presented here.

for eye care from nearby areas *immediately following* the holding of a diagnostic eye clinic. Because our prevention of blindness activities are confined almost entirely to the rural districts and patients have to come long distances to the clinic, notices and advance publicity regarding the clinic are confined to a single county. But, as soon as the clinic follow-up work is begun, word-of-mouth publicity spreads rapidly to the adjoining counties. Indigent persons want to know how and where they can get their eyes 'doctored,' and health and welfare workers ply us with requests for diagnostic clinics for their counties.

"Although the prevention of blindness department of the Missouri Commission for the Blind during 1937–1938 arranged for 7,720 eye examinations, 458 eye operations (paying for hospitalization), and for 6,365 refractions (paying for the glasses), at the close of the biennium there were in our files 10,102 written requests for eye care that had either not been granted, or where further eye care was indicated . . . .

"In an effort to arrange eye examinations for these 10,102 patients, it was necessary to discontinue the holding of diagnostic clinics and concentrate on these requests. Intensive work by the prevention of blindness field workers has been done in the counties where the greatest number of appeals for eye care emanated."

—*Missouri Commission for the Blind, St. Louis, Missouri*

New York

"The course entitled 'A Survey of Eye Conditions' (4 points credit) will be available to students planning to attend New York University summer session. This course, offered by New York University since 1932 in co-operation with the Bureau of Services for the Blind, New York State Department of Social Welfare, has become increasingly popular because of the material offered relative to sight conservation and prevention of blindness. It is designed for workers in the fields of education, social welfare, public health nursing, and allied fields. It is planned to present a background of the conservation of sight, together with an appreciation of the medical, social and educational needs and responsibilities in relation to acute and chronic eye conditions. Lectures will be supplemented by clinic demonstrations.

"Please address inquiries regarding registration to Mr. James Meyers, Director of Course, School of Education, New York University, Washington Square, New York City."

—New York State Department of Social Welfare, New York, New York

Tennessee

"During the ten and one-half months in which this Division has been carrying on its work, the following things have been accomplished, of which it is justly proud—66 persons have had their sight restored in whole or in part in one or both eyes, of which 36 have been children, 30 adults. Fourteen persons have had operations to restore sight, of which one has apparently been a 'failure'; five persons have had six operations to prevent blindness, of which one has apparently failed, for a total of 20 operations to restore sight and prevent blindness . . . .

"At the present time this Division is utilizing six definite approaches to the prevention of blindness and conservation of vision—namely, eugenics, legal, educational, medical, sight-saving classes, and the preschool illiterate vision-testing approach. These methods are being utilized not only through the medium of speech but through the press, moving pictures, radio talks and the printed pamphlet. This Division is now engaged in the preparation of a booklet which will carry all essential information in regard to the prevention of blindness and conservation of vision, and about all the causes of blindness prevalent in Tennessee, and written in a language which the laity will be able to understand . . . ."

—Division, Prevention of Blindness and Conservation of Vision, State of Tennessee, Department of Institutions, Nashville, Tennessee

Texas

". . . The nature of our work is as follows:

"1. Prevention of ophthalmia neonatorum by the furnishing of silver nitrate ampules to the city and county health officers and the midwives, by instructions to and supervision of midwives, and by instructions to expectant mothers by our local health services.

"2. The treatment of syphilitic keratitis and co-operation of the practising physicians throughout the state. We have established a number of venereal disease clinics in our larger cities and are

furnishing arsenic and bismuth to physicians throughout the state for indigent cases.

"3. General attempts at conservation of vision. Our efforts along this line are limited to the finding of visual defects in school children and other examinations, urging the parents of these children to have such defects cared for. At the present time there are no clinical facilities available through this department.

"It will be extremely difficult for us to give you an accurate statistical report upon all phases of this work, but we will be happy to co-operate with you in any way we can, conforming, of course, to our general policies."

—*Texas State Board of Health, Austin, Texas*

Note and Comment

Research Program in Trachoma.—According to an item appearing in a recent issue of the *Archives of Ophthalmology*, the Indian Medical Service has set up a research program in trachoma under the supervision of Dr. Polk Richards and Dr. Fred Loe, of the Indian Medical Service, and Dr. Phillips Thygeson, of the Eye Institute, New York. The committee will carry on research treatment of trachoma with sulfanilamide and sulfanilamide derivatives. A comparative study of therapy with sulfanilamide and antimony and potassium tartrate will be made by Dr. Julianelle, of St. Louis, in co-operation with the physicians in the Indian Medical Service.

Greater New York Safety Conference.—The subject of sight conservation in industry was made a significant part of the program of the annual convention of the Greater New York Safety Council, in which the National Society for the Prevention of Blindness regularly participates. The Society this year not only is maintaining an exhibit booth, but is co-operating in a half-day's program, "Vision and Eye Protection," under the chairmanship of Dr. Leonard Greenburg, executive director of the Division of Industrial Hygiene, New York State Department of Labor. The program for this section reads as follows:

"The Head and Eye Protection Code of the National Bureau of Standards"—M. G. Lloyd, National Bureau of Standards, Washington, D. C.

"Fifteen Years' Progress in Eyesight Conservation in Industry"—Louis Resnick, director industrial relations, National Society for the Prevention of Blindness, New York.

"The Industrial Eye Protection Program: How Is It Set Up? How Is It Put Across? How Is It Kept Across?"—Harry Guilbert, director of safety, The Pullman Company, Chicago.

It is expected that a forthcoming issue of the REVIEW will present these papers as a symposium, and that reprints will be made available upon request.

Another aspect of sight conservation presented during the con-

vention was the subject of industrial lighting, under the chairmanship of D. W. Atwater, president of the Illuminating Engineering Society.

Preventing Babies' Sore Eyes in Illinois.—A current issue of the *Illinois Health Messenger* says: "Silver nitrate solution sufficient to give prophylactic treatment to the eyes of 166,052 newborn babies was distributed last year. The general use of this preparation has practically eliminated ophthalmia neonatorum, an infection of the eyes at birth which formerly accounted for about 20 per cent of blindness in children.

"This is an increase of 24,627 over the amount distributed in 1937."

Clinical Tests Show Degrees of Night Blindness.—Incident to a report of the case history of a night-blind patient materially relieved by administration of concentrated doses of Vitamin A, a Liverpool hospital reporting in *The Lancet* affords an interesting description of the procedure and equipment employed in determining the degree of visual deficiency in patients complaining of night blindness. Although such persons may have normal daylight vision, night blindness characteristically becomes apparent only in darkness *after* exposure to light. In mild cases, the eyes require something over 30 seconds to adjust following a sudden change from light to darkness, whereas a severe case, such as is described in the article cited, may require as long as 85 seconds. These figures may serve to explain, but can only emphasize, the much-publicized dangers of night driving involving, either as motorist or pedestrian, persons so afflicted.

In tests employing a device known as the Biophotometer, the subject, looking into a lightproof eye-piece, gazes for a given period at a single illuminated standard lamp. Following this exposure, the light is switched off and in its place appears a group of five lights of varied intensity, so arranged that two which are dim and two which are brilliant are ranged on either side of a fifth of intermediate brightness. This quincunx will not be immediately visible to the night-blind subject, whose measure of adaptation is determined by the length of time necessary for him to perceive the central intermediate light.

The third step in testing is to show the same group of five lights, gradually dimming them until the center light becomes invisible to the patient and measuring the time elapsing from exposure to the moment when the subject can no longer perceive the central light. The longer the period, the more severe the degree of night blindness.

It is reported that, in spite of the tendency of patients to "anticipate" the appearance or disappearance of the lights when tests must be repeated, with conscious co-operation on the part of the subject it is possible to maintain a high degree of accuracy in recording adaptation time.

Brazil Forms National Society for the Prevention of Blindness.—Word has been received from Brazil of the formation of a Brazilian National Society for the Prevention of Blindness under the sponsorship of the Brazilian Society of Ophthalmology.

The Brazilian society indicates that it expects to follow the general outline of the program as carried out in the United States.

Society's Talking Slide Film Active in State Programs.—Within the approximate length of six months' time, the Society's talking slide film, "The Nurse's Responsibility in Saving Sight," has received wide distribution—there have been 30 sales in 17 states and the District of Columbia, Hawaii and England. Represented in the states are ten state health departments; four state welfare departments; six local public health agencies; two schools of nursing; two local prevention of blindness agencies; as well as a number of other groups.

Writing on the Society's talking slide film as a medium of education, an instructor of nursing education said:

"The pictures are excellent and the accompanying lecture is varied, some explanations being given by the doctor, others by the nurse. The content has been well selected to give a comprehensive view of the causes of blindness and the function of the nurse in preventing blindness from each of these causes. The provision for interrupting the record, allowing for further discussion and explanation at any point in the film, adds to its value as a teaching device.

"My experience in the use of the film showed it to be stimulating and instructive for both graduate and student nurses."

Current Articles of Interest

Observations on the Action of Paredrine Hydrobromide Ophthalmic Solutions, Lyle S. Powell, M.D., and Marshall E. Hyde, M.D., the *Journal of the Kansas Medical Society*, December, 1938, published monthly by the Kansas Medical Society, Topeka, Kansas. The authors provide the following summary: "Paredrine hydrobromide one per cent solution produced a uniform increase in the size of the pupils amounting to two millimeters or more in a group of patients between 16 and 30 years of age, and in another group of patients between 50 and 70 years of age. This mydriasis showed a tendency to subside four hours following drug administration in both groups. There was observed a slight but definite tendency toward a decrease in accommodation in both groups during the mydriasis."

An Aid Toward Correctly Inserting Contact Lenses, Joseph I. Pascal, M.D., *Archives of Ophthalmology*, March, 1939, published monthly by American Medical Association, Chicago, Ill. Although insertion without orientation is comparatively simple with a contact lens having a uniform scleral curvature with a round corneal section set in the middle, and an oval lens with radically different horizontal and vertical diameters is readily placed on the sucker and inserted either by the physician or the patient, Dr. Pascal suggests a simple and practical means of insuring the correct insertion of contact lenses having different scleral curvatures in different directions, and/or an oval corneal section centered or decentered in the scleral circumference.

Since the finely etched line usually placed on the inner, nasal side of most contact lenses is virtually invisible to the physician once the lens has been placed on the sucker, and also to the patient inserting his own lens once he has looked away after first determining its position, the lens may be thrown off its proper horizontal position through accidental rotation of the sucker in the hand as the lens is being conveyed to the eye. The author, therefore, suggests the practical expedient of marking one-half of the top of the rubber

sucker with a white line of adhesive tape which will serve as a conspicuous guide. Placed on the sucker with its etched line exactly aligned with the white marker, approached to the eye with the white strip directed toward the inner canthus, and visible between the cases of the fingers, the lens is correctly inserted.

Light Adaptation at the Fovea for Normal Eyes, W. D. Wright, D.Sc., A.R.C.S., *British Journal of Ophthalmology,* January, 1939, published monthly by the British Journal of Ophthalmology, Ltd., London, England. Author describes a new model of subjective photometer which records the effects of adapting the eye to a given intensity, and analyzes tests on 100 observers. The results are discussed in relation to susceptibility of different observers to glare; to photo-chemical reaction in the retina, and to reaction to the method for pathological investigation.

Methods of Testing for Colour Vision and Theoretical Deductions From Observations on Colour Vision, H. E. Roaf, M.D., D.Sc., *The British Medical Journal,* August 27, 1938, published weekly by the British Medical Association, London, England. The author concludes: "In this paper an attempt has been made to point out the difference between normal and defective colour vision, to describe the means of detecting defects in colour vision, and the possibility of compensating for defects in colour vision by binocular fusion of colours. The usual type of defective colour vision is a failure to distinguish red, yellow and green—that is, red-green confusion. There is no failure to distinguish blue from green. We can say that the normal person and the hypochromat distinguish blue from not-blue. The normal person distinguishes red from not-red. That which is neither red nor blue is called green. The hypochromat does not distinguish red from not-red, and anything which is not blue he tends to call yellow, as this is the brightest part in the not-blue region of the spectrum."

Vision in Nature and Vision Aided by Science: Science and Warfare, the Rt. Hon. Lord Rayleigh, *Science,* August 26, 1938, and September 2, 1938, published weekly by the American Association for the Advancement of Science, New York. A discussion of the structure and functions of the eye with special reference to artificial

aids in improving vision, such as spectacle and telescope lens and improvements in color discrimination.

Second Annual Summary of Fourth of July Injuries Due to Fireworks and Explosives; Second Series (1938); *Journal of the American Medical Association*, Vol. XII, No. 3, January 21, 1939. In summing up the study, the following comment is presented:

"More striking than ever is the evidence in 1938 that many regions are woefully lacking in adequate legislation for the prevention of injuries and fatalities from fireworks. Numerous states and cities have shown serious increases in recorded accidents. In general only those states which have enacted and enforced state-wide laws have shown any evidence of satisfactory control. Some of the states with anti-fireworks legislation have failed to realize the benefits which might have been expected because of the lack of such legislation in neighboring territories and the ease of transportation. With the high incidence of injuries from fireworks continuing unabated in spite of the knowledge of how to overcome this danger, there is no longer any excuse for failure to adopt effectual state legislation."

The Position of Orthoptics in Headache from Eyestrain, J. D. Maude, *Medical Journal of Australia*, February 11, 1939. Writing on orthoptics, Dr. Maude presents the following interesting comment on blinking:

"I have not yet made a sufficient number of examinations to enable me to make more than a few suggestions about blinking in children; but I believe that blinking is caused as much, if not more, by binocular discord as by errors of refraction. After refraction is tested, whether glasses are prescribed or not, a child whose parents complain that he blinks, screws up his eyes, tilts his head, or reads with his face almost on the page, should be examined with an amblyoscope. It is necessary to find out to what extent the child is master of his binocular vision. In most cases phorias that are detected in later life must have been present during childhood. Squinting and blinking begin at the same age. Possibly squints are manifestations of failure to master the binocular mechanism, and blinking and allied symptoms are the earliest signs of heterophorias, including inadequate convergence. . . ."

Book Reviews

TEXTBOOK OF EYE, EAR, NOSE AND THROAT NURSING. Abby-Helen Denison, R.N. Revised by Lyyli-Eklund, R.N. New York: Macmillan Co., 1938. 367 p.

The first eight chapters of this revised text deal entirely with the eye, emphasizing the nursing procedures carried out in the care of eye patients. Only this first section of the book will be considered in this review.

There is a concise description of the anatomy and physiology of the eye which, supplemented by a more detailed anatomy text, should give the student nurse an adequate understanding of this basic topic. The diseases of the eye are subdivided according to anatomical structure, and clearly described. The drugs commonly used in the treatment of eye conditions are named and classified and their method of use explained. A detailed description of nursing procedures is given, with emphasis on the necessary careful handling of the eye and care of equipment. Various types of bandages and dressings are described with illustrations. There is one chapter dealing briefly with the surgical equipment and its care, and another with the duties and responsibilities of the nurse in the out-patient department. The chapter on the hygiene of the eye is a much needed addition to the text, but requires amplification.

The reviewer believes that in eye nursing the psychological problems are so numerous that any text on the subject should give a definite place to the mental care of eye patients. This has not been done.

The logical sequence of arrangement, the clearness of presentation, and the suggested references make this a book which is easily used and valuable both to the student and to the instructor.

—CORA L. SHAW, R.N.

DOCUMENTA OPHTHALMOLOGICA: A SYNTHESIS OF RECENT ADVANCES IN OPHTHALMOLOGY, Volume I. A. J. Schäffer, editor. Zurich: Masson and Co., 1938. 482 p.

The mass of world medical literature issued weekly, monthly, bi-monthly, and annually has reached such enormous proportions

that it has become quite impossible for the most voracious reader to devour it all. As to the practical work-a-day doctor who must devote some of his time to his clinical duties, much valuable material must inevitably escape his attention. While he might, therefore, look a little askance at any journalistic addition to the ophthalmological output of new matter, the present publication will come rather as a relief, as it is designed to be a summary of all of the important and new work bearing on this specialty throughout the world. Practically all of the ophthalmic periodicals present abstracts of relevant literature. These are necessarily so brief that, while they are of informative value as to what is being done, the interested reader must seek the original sources if he wishes a comprehensive understanding of the matter presented.

The purpose of the *Documenta Ophthalmologica* is to synopsize in a single rather complete article all that is worth while that clinical and laboratory research has brought to light.

The section pertaining to the eye is but one of a series of similar publications, including those on oto-laryngology, obstetrics and gynecology, dermatology, neurology, and psychiatry. Under the editorial supervision of Dr. A. J. Schäffer, together with such names as those of Adler, Bailliart, Duke-Elder, F. P. Fischer, Granit, Hecht, Heine, Magitot, Wald, and Weve, the thoroughness and scientific value of the subjects reviewed will be assured. The topics which appear in the index of the first volume are all of living and practical interest. Ragner Granit, professor of physiology at the University of Helsingfors, occupies 72 pages in reviewing the "Processes of Adaptation in the Vertebrate Retina in the Light of Recent Photo-Chemical and Electrophysiological Research," to which is annexed an extensive bibliography, a subject of great interest today because of the effect of a deficiency of vitamin A on the visual purple and dark adaptation. Of no less present-day value is the 81-page review of "The Water Content in the Eye and its Distribution," by Professor Fischer of Utrecht. Equally vital are the 91 pages given by Bailliart of Paris in his studies of "The Retinal Circulation" and his clinical evaluation of the various forms of hemorrhage which may be presented.

Karrer of the Chemical Institute of the University of Zurich occupies 88 pages in a résumé of the importance of "Keratoinoid"

in connection with the eyes, which most fittingly goes with Dr. Schäffer's summation in a dozen pages of "The Vitamins in Ophthalmology," both of which have a direct bearing on the extensive paper of Magitot (140 pages), on what is the most urgent problem in ophthalmology today and one which will soon be actively attacked, the symptomatology and the pathogenesis of glaucoma.

Equally important and timely is the presentation by Nordmann and Reiss from the Ophthalmic Clinic and the Institute of Physiobiology of the University of Strasbourg in the study of the problem of the "Opacification of the Crystalline from a Physico-Chemical Standpoint." Only an introduction to the subject is given in the 50 pages allotted to it, but readers will look forward avidly for fuller information on what the scientific world knows of cataract.

All of these studies are abundantly documented so that the student may easily seek the original sources for further verification.

The articles appear in one of the four principal languages, English, French, German, and Italian, and are made accessible to the entire ophthalmological world. The volume is well printed, but on glazed not mat paper, which would have made more comfortable reading. The subject matter is not printed at the top of each page, as is customary in medical periodical literature, so that it is somewhat difficult to determine where each article begins. Filling as it does a hitherto unsupplied need, it should prove a welcome addition to the literature of every progressive ophthalmologist.

—Park Lewis, M.D.

Psychological Optics, Vernon W. Grant, M.A., Professional Press, Chicago, 1938.

Vernon W. Grant has written a comprehensive review of the psychologic factors associated with the eye and its functions. Numerous references to the modern theories of visual psychology are appended. The book is written in a clear and concise manner and is useful for the student and practitioner. The book is well illustrated with diagrammatic drawings.

In the author's discussions of behavior, the visual reaction system, visual perception, attention, visual sensations and illusions of space, he has supplied an essential background for the proper understanding of certain visual reactions and their derangements.

The author has confined his discussion mainly to the psychologic aspects of optics and has refrained from too lengthy a discussion of the pathologic and physiologic considerations of the subject.

—CONRAD BERENS, M.D.

PREDICTION AND PREVENTION OF READING DIFFICULTIES, Margaret A. Stanger and Ellen K. Donohue. New York: Oxford University Press, 1937. 191 p.

At a time when much attention is being given to remedial reading, it is exceedingly encouraging to have made available a book dealing with the much more important aspects of the problem, the prediction and prevention of reading difficulties.

The authors are concerned to find that after taking into consideration the possibility of eye or ear defects, low intelligence and other recognized reasons for possible failures in reading, an appalling number of well-endowed children suffering from none of these usually considered hindrances to reading present grave difficulties.

The authors are confident that before teaching procedures can be used efficiently an understanding of the theories of neurologists in regard to this problem is essential. Hence the theories of well-known specialists in this line are presented in their own words, accompanied by a simplified explanation.

In addition to a consideration of these, emphasis is laid upon family history and the authors present a wealth of material in the form of simple, inexpensive tests for young children that will aid in making predictions of possible reading difficulties sufficiently in advance of the time when reading is usually taught to eliminate the causes in cases in which this is possible, and in other cases to adapt methods to the particular needs of the child showing deviations. The latter part of the book presents suggestions of how predicting reading difficulties may help in their prevention.

Books Received

THE 1938 YEAR BOOK OF EYE, EAR, NOSE AND THROAT, edited by E. V. L. Brown, M.D., Louis Bothman, M.D., and Samuel J. Crowe, M.D. Chicago: The Year Book Publishers, Inc., 1937. 631 pp. ill.

CO-OPERATION PRINCIPLES AND PRACTICES, Eleventh Yearbook, Department of Supervisors and Directors of Instruction, National Education Association. Washington, D. C.: 244 pp.

Current Publications on Sight Conservation

Note.—The National Society for the Prevention of Blindness presents the most recent additions to its stock of publications. Except for the more expensive ones, single copies are sent free upon request. Unless otherwise specified, they are reprinted from THE SIGHT-SAVING REVIEW. New publications will be announced quarterly.

286. Emotional Factors in Education of the Visually Handicapped, Eleanor L. Hearon. 8 p. 5 cts. Points out the emotional involvements as well as the educational, social and economic drawbacks of the visually handicapped. Reprinted from *The Sight-Saving Class Exchange*, February, 1939.

287. A Demonstration Eye Safety Lesson, given by the pupils in the advanced biology senior class, New Haven High School, New Haven, Conn. Reprinted from *The Sight-Saving Class Exchange*, April, 1939. 6 p. $2.00 per 100.

288. Development of the Normal Eye in Infancy and Childhood, Willis S. Knighton, M.D. 8 p. 5 cts. Ophthalmic information which all pediatricians should take into consideration in the care of their patients.

289. The Psychological Touch in Straightening Cross-Eyes, Meta Rosenthal. 8 p. 5 cts. In the treatment of cross-eyes, the parents and teachers as well as the oculist are responsible for preventing psychological complexes.

290. Injuries to the Eyes, Joseph Dessoff, M.D. 12 p. 10 cts. The eyes have become subject to injuries brought about especially by industrial hazards, and require consideration on the part of industry as well as medicine.

291. Sight-Saving Classes (An Excerpt from the German), Professor Dr. M. Bartels. 8 p. 5 cts. The similarities as well as the differences in sight-saving classes abroad and in America are brought out in this article, translated from the German.

292. The College Student and Dormitory Study Facilities, Anette M. Phelan, Ph.D. 12 p. 10 cts. Emphasizes the necessity for a continuous program of eye health during the college age, and presents a description of reading and study facilities conducive to good eye health.

293. An Evaluation of Vision-Testing Methods in Schools, John B. Hitz, M.D. 8 p. 5 cts. The author presents this useful evaluation of the various methods of testing vision in the schools—of special interest to school physicians, school nurses and teachers.

D124. Survey of Fireworks Accidents, 1938. Reprinted from the *Journal of the American Medical Association*, January 21, 1939. 7 p. $1.75 per 100. The 1938 review by the American Medical Association of Fourth of July injuries in the United States.

D125. Preparing the Handicapped Child to Live, May E. Bryne. Reprinted from *Public Health Nursing*, December, 1938. 8 p. The author emphasizes the necessity for considering the handicapped child as a normal human being, and discusses visual handicaps along with other physical handicaps requiring special educational facilities.

D126. Relation of the Ophthalmologist to the Pediatrist, Warren S. Reese, M.D. Reprinted from the *Pennsylvania Medical Journal*, February, 1939. 3 p. $1.75 per 100. Points out the various eye complications appearing in infancy and childhood in which the pediatrician and the ophthalmologist can cooperate to the best interests of their young patients.

Contributors to This Issue

Dr. Willis S. Knighton, a frequent contributor to the SIGHT-SAVING REVIEW, is a practising ophthalmologist in New York City.

Meta Rosenthal is a professional writer from Chicago, whose articles on scientific subjects have appeared in a number of popular and scientific magazines.

A practising ophthalmologist of Dortmund, Germany, **Professor Dr. M. Bartels** has long been especially interested in the advancement of the sight-saving class movement in Germany. **Dr. Harry S. Gradle,** a practising ophthalmologist of Chicago, Illinois, and vice-president of the Illinois Society for the Prevention of Blindness, edited the translation of the article by Dr. Bartels.

Dr. Anette M. Phelan, associate in health education of the Society, has emphasized the subject of eye health of college students among her activities.

Dr. Joseph Dessoff devotes his time to the practice of ophthalmology in Washington, D. C.

Dr. John B. Hitz is a practising ophthalmologist of Milwaukee, Wisconsin.

Book reviewers: **Cora L. Shaw, R.N.,** Institute of Ophthalmology, Presbyterian Hospital, New York, N. Y.; **Dr. Park Lewis,** first vice-president of the International as well as the American National Society for Prevention of Blindness; **Dr. Conrad Berens,** member of the Society's Board of Directors.